Needle roller bearings

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Contents

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

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

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

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

SKF – the knowledge engineering company

Foreword

Many bearing arrangements have limited radial space, but require bearings having a high load carrying capacity and a high degree of stiffness. SKF needle roller bearings with their low cross section fulfil these requirements. They also provide an economical solution to these challenges if the shaft or housing bore can serve as raceways.

SKF track runner bearings are an excellent choice for all types of cam drives, tracks, conveyor systems etc. where guidance is required.

For motorsport applications, SKF Racing has been using customized, high-performance needle roller bearings for many years. These special needle roller bearings are used in the most demanding Formula One applications, such as gearboxes. Using different advanced materials, coatings and designs, SKF's advanced engineering knowledge can improve the performance and reliability of virtually any application.

SKF supplies needle roller bearings as well as track runner bearings in many designs, series and sizes, which make them appropriate for various operating conditions.

This catalogue presents the current standard assortment of SKF needle roller bearings, track runner bearings and radial shaft seals with low cross sectional height.

Structure of the catalogue

The catalogue starts with general product information followed by nine main chapters, which are marked with numbered blue tabs in the right margin:

- Chapter 1 provides bearing terminology and types as well as selection, design and application recommendations.
- Chapters 2 to 8 describe the various needle roller bearing types and their associated components. Each chapter contains descriptions of the products as well as product tables, which list data for selecting a bearing and designing the bearing arrangement.
- Similarly, chapter 9 presents the various designs and series of track runner bearings, incorporating needle or cylindrical rollers.

The index at the end lists all products presented in this catalogue in alphanumeric order.

About the data in this catalogue

The data in this catalogue relates to SKF's state-of-the-art technology as of mid-2009. The data may differ from that shown in earlier catalogues because of revised methods of calculation, redesign or technological developments.

SKF reserves the right to make continuing improvements to SKF products with respect to materials, design and manufacturing methods, as well as changes necessitated by technological developments.

The units used in this catalogue are in accordance with ISO (International Organization for Standardization) standard 1000:1992, and SI (Système International d'Unités). A table for unit conversions can be found on **page 7**.

Other SKF catalogues

The total SKF product portfolio is much broader than only needle roller bearings and track runner bearings. Product information is also available via the SKF website at www.skf.com. The *SKF Interactive Engineering Catalogue* provides not only product information, but also online

calculation tools, CAD drawings in various formats, and search and selection functions.

The main printed SKF catalogues are:

- General Catalogue
- High-precision bearings
- Y-bearings and Y-bearing units
- Spherical plain bearings and rod ends
- Bearing housings
- Slewing bearings
- Linear motion standard range
- SKF Maintenance and Lubrication Products
- Centralized lubrication systems
- Industrial shaft seals
- SKF Power transmission products

For more information about SKF products and services, contact your local SKF representative or SKF Authorized Distributor.

More advantages

SKF aims to deliver industry-leading, high value products, services and knowledge-engineered solutions. Many capabilities contribute to the overall value customers receive in making SKF their supplier of choice, such as:

- simplified bearing selection
- short delivery times
- worldwide availability
- commitment to product innovation
- state-of-the-art application solutions
- extensive engineering and technology knowledge in virtually every industry

Unit conversions

Quantity	Unit	Conversion			
Length	inch	1 mm	0,03937 in	1 in	25,40 mm
	foot	1 m	3,281 ft	1 ft	0,3048 m
	yard	1 m	1,094 yd	1 yd	0,9144 m
	mile	1 km	0,6214 mile	1 mile	1,609 km
Area	square inch	1 mm^2	0,00155 sq.in	1 sq.in	645,16 mm^2
	square foot	1 m^2	10,76 sq.ft	1 sq.ft	0,0929 m^2
Volume	cubic inch	1 cm^3	0,061 cub.in	1 cub.in	16,387 cm^3
	cubic foot	1 m^3	35 cub.ft	1 cub.ft	0,02832 m^3
	imperial gallon	1 l	0,22 gallon	1 gallon	4,5461 l
	U.S. gallon	1 l	0,2642 U.S. gallon	1 U.S. gallon	3,7854 l
Velocity, speed	foot per second	1 m/s	3,28 ft/s	1 ft/s	0,30480 m/s
	mile per hour	1 km/h	0,6214 mile/h (mph)	1 mile/h (mph)	1,609 km/h
Mass	ounce	1 g	0,03527 oz	1 oz	28,350 g
	pound	1 kg	2,205 lb	1 lb	0,45359 kg
	short ton	1 tonne	1,1023 short ton	1 short ton	0,90719 tonne
	long ton	1 tonne	0,9842 long ton	1 long ton	1,0161 tonne
Density	pound per cubic inch	1 g/cm^3	0,0361 lb/cub.in	1 lb/cub.in	27,680 g/cm^3
Force	pound-force	1 N	0,225 lbf	1 lbf	4,4482 N
Pressure, stress	pounds per square inch	1 MPa	145 psi	1 psi	6,8948 × 10^3 Pa
Moment	inch pound-force	1 Nm	8,85 in.lbf	1 in.lbf	0,113 Nm
Power	foot-pound per second	1 W	0,7376 ft lbf/s	1 ft lbf/s	1,3558 W
	horsepower	1 kW	1,36 HP	1 HP	0,736 kW
Temperature	degree	Celsius	$t_C = 0,555\ (t_F - 32)$	Fahrenheit	$t_F = 1,8\ t_C + 32$

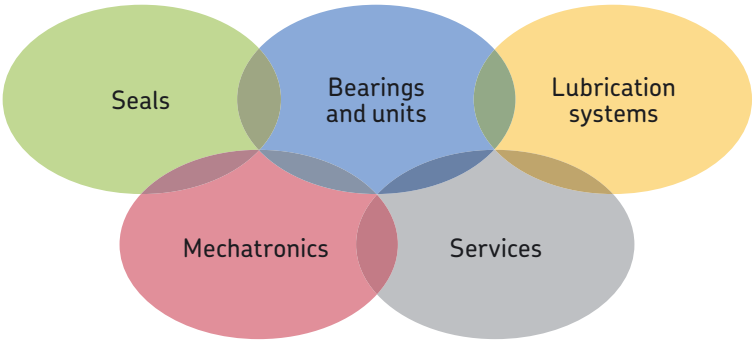
SKF – the knowledge engineering company

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

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

The SKF Group is globally certified to ISO 14001, the international standard for environmental management, as well as OHSAS 18001, the health and safety management standard. Individual divisions have been approved for quality certification in accordance with either ISO 9001 or other customer specific requirements.

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



Evolving by-wire technology

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

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

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

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

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

Maintaining a 350 km/h R&D lab

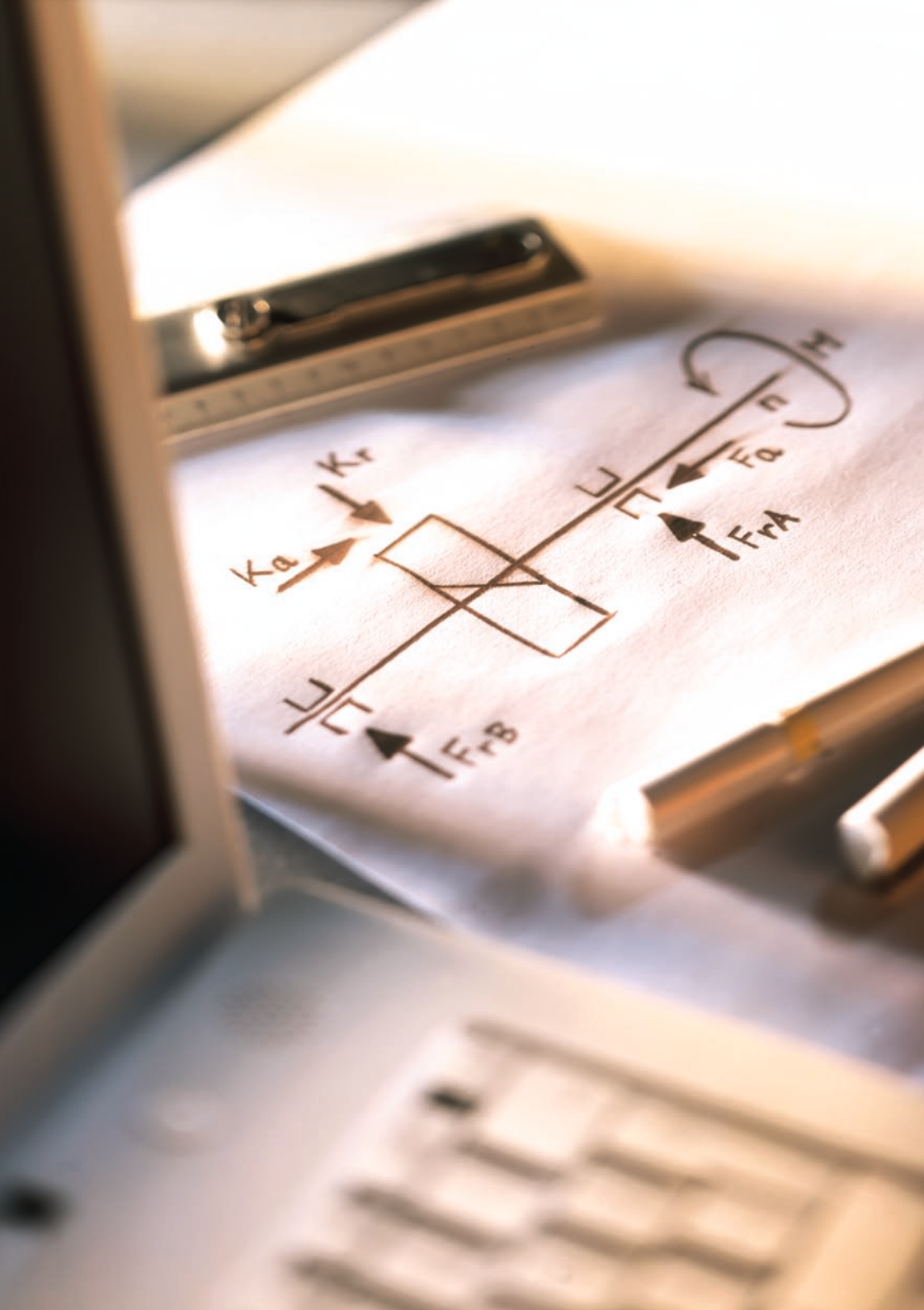
In addition to SKF's renowned research and development facilities in Europe and the United States, Formula One car racing provides a unique environment for SKF to push the limits of bearing technology. For over 50 years, SKF products, engineering and knowledge have helped make Scuderia Ferrari a formidable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

Delivering Asset Efficiency Optimization

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

Planning for sustainable growth

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


Kr
Ka
Fa
FrA
FrB

Principles of bearing selection and application

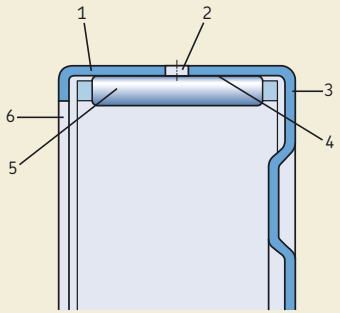
1

Bearing terminology

To better understand frequently used needle roller and track runner bearing terms, definitions are provided in **fig. 1** to **6**.

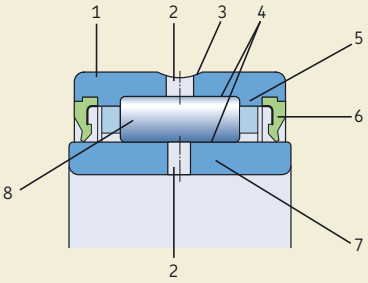
Drawn cup needle roller bearings (→ fig. 1)
1 Drawn cup
2 Lubrication hole
3 Closed end
4 Raceway
5 Needle roller and cage assembly
6 Open end

Fig. 1



Needle roller bearings with machined rings (→ fig. 2)
1 Outer ring
2 Lubrication hole
3 Annular groove
4 Raceway
5 Integral flange
6 Seal
7 Inner ring
8 Needle roller and cage assembly

Fig. 2



Needle roller thrust bearings with a centring spigot (→ fig. 3)
1 Centring spigot
2 Needle roller and cage thrust assembly
3 Raceway

Fig. 3

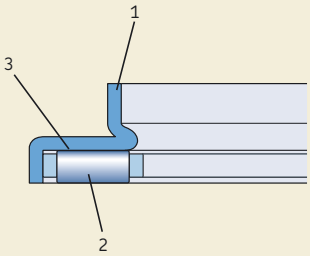
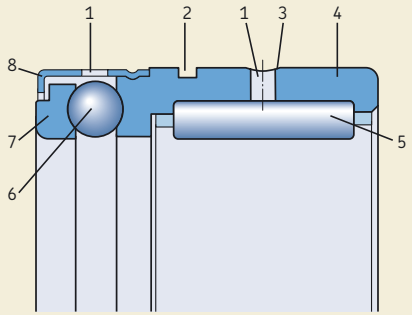
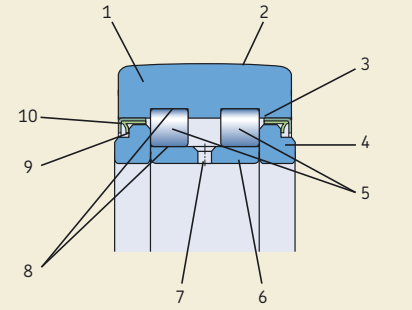


Fig. 4



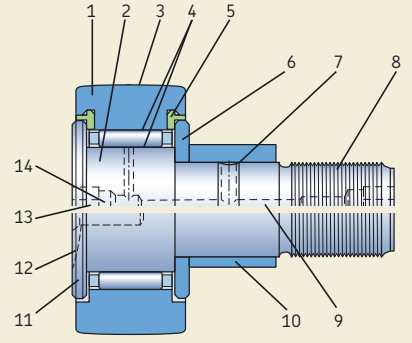
Needle roller / thrust ball bearings (→ fig. 4)
1 Lubrication hole
2 Snap ring groove
3 Annular groove
4 Outer ring
5 Needle roller and cage assembly
6 Thrust rolling element: ball (full complement)
7 Shaft washer
8 Steel cover

Fig. 5



Support rollers (→ fig. 5)
1 Outer ring
2 Outer ring running surface
3 Integral flange
4 Loose flange ring
5 Rolling element: cylindrical roller (two rows full complement)
6 Inner ring
7 Lubrication hole
8 Raceway
9 Contact seal
10 Sheet metal angle ring

Fig. 6



Cam followers (→ fig. 6)
1 Outer ring
2 Stud (pin)
3 Outer ring running surface
4 Raceway
5 Axial sliding ring
6 Pressed-on flange ring
7 Annular groove
8 Thread
9 Lubrication duct
10 Eccentric collar
11 Head/ integral flange
12 Slot
13 Recessed hexagon
14 Hole for grease fitting


SKF

Bearing types

Needle roller bearings

Needle roller bearings are bearings with cylindrical rollers that are small in diameter. In spite of their low cross section, needle roller bearings have a high load carrying capacity and are therefore extremely suitable for bearing arrangements where radial space is limited.

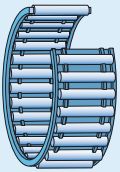
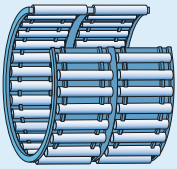
SKF supplies needle roller bearings in different designs and in a wide range of sizes, which are appropriate for different applications. In addition to customized designs, they comprise the following types and components:

- needle roller and cage assemblies
- drawn cup needle roller bearings
- universal joint bearings
- needle roller bearings with machined rings
- alignment needle roller bearings
- needle roller thrust bearings
- bearing washers
- combined needle roller bearings
- needle roller bearing inner rings
- needle rollers
- radial shaft seals with low cross sectional height

Basic information about the different needle roller bearing types, washers, and seals is provided in the following overview.

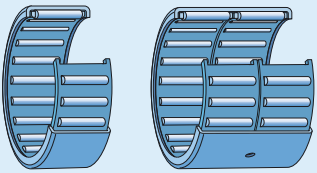
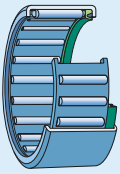
Needle roller and cage assemblies

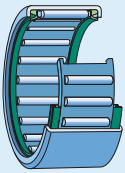
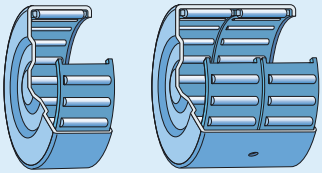
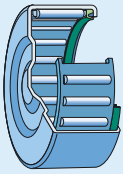
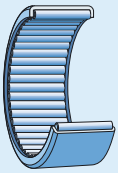
See chapter 2 starting on **page 57**

Bearing design Needle roller and cage assemblies	Designation series Inside diameter range	Characteristics
Single row		
	**K .. TN** F_w = 3 – 45 mm	Polyamide 66 cage
	K F_w = 14 – 265 mm	Steel cage
Double row		
	**K .. ZWTN** F_w = 32 mm	Polyamide 66 cage
	K .. ZW F_w = 24 – 95 mm	Steel cage

Drawn cup needle roller bearings

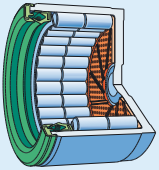
See chapter 3 starting on **page 75**

Bearing design Drawn cup needle roller bearings	Designation series Inside diameter range	Characteristics
With open ends, HK series, not sealed		
	**HK .. TN** F_w = 3 mm	Polyamide 66 cage
	HK F_w = 4 – 60 mm	Steel cage, size-dependent single or double row (→ product tables)
With open ends, HK series, sealed on one side		
	**HK .. RS** F_w = 8 – 50 mm	Steel cage, factory greased

Bearing design Drawn cup needle roller bearings	**Designation series** Inside diameter range	**Characteristics**
With open ends, HK series, sealed on both sides		
	**HK ...2RS** F_w = 8 – 50 mm	Steel cage, factory greased
With a closed end, BK series, not sealed		
	**BK .. TN** F_w = 3 mm **BK** F_w = 4 – 45 mm	Polyamide 66 cage Steel cage, size-dependent single or double row (→ product tables)
With a closed end, BK series, sealed		
	**BK .. RS** F_w = 10 – 25 mm	Steel cage, factory greased
With open ends, HN series, full complement, not sealed		
	**HN** F_w = 10 – 50 mm	Factory greased to secure the rollers

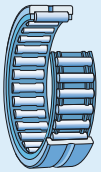
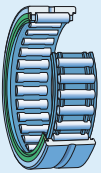
Universal joint bearings

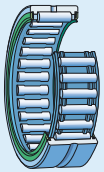
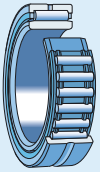
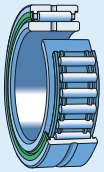
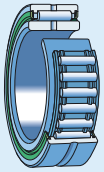
Not covered in this catalogue.
For additional information, refer to the *SKF Interactive Engineering Catalogue*.

Bearing design Universal joint bearings	**Designation series**	**Characteristics**
	**BNKB**	Specific cold forged cup needle roller bearings for universal joints of commercial vehicle propeller shafts

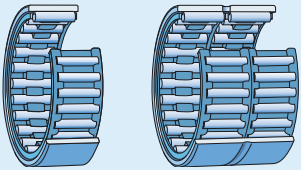
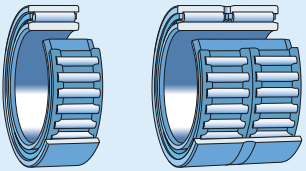
Needle roller bearings with machined rings

See chapter 4 starting on **page 97**

Bearing design Needle roller bearings with machined rings	**Designation series** Inside diameter range	**Characteristics**
With flanges, without an inner ring, not sealed		
	**NK .. TN** F_w = 5 – 60 mm **NK** F_w = 12 – 110 mm **NKS** F_w = 20 – 75 mm **RNA 49** F_w = 14 – 160 mm **RNA 69** F_w = 16 – 110 mm **RNA 48** F_w = 120 – 415 mm	Integral flanges, annular groove and one or more lubrication holes (size dependent) If $F_w \leq 10$ mm: with integral closure rings, without lubrication hole or annular groove RNA 69 series bearings with an outside diameter $D \geq 52$ mm are designed as double row bearings
With flanges, without an inner ring, sealed on one side		
	**RNA 49.. RS** F_w = 14 – 58 mm	Integral flanges, annular groove and one or more lubrication holes (size dependent), factory greased

Bearing design Needle roller bearings with machined rings	Designation series Inside/bore diameter range	Characteristics
With flanges, without an inner ring, sealed on both sides		
	**RNA 49...2RS** F_w = 14 – 58 mm	Integral flanges, annular groove and one or more lubrication holes (size dependent), factory greased
With flanges, with an inner ring, not sealed		
	**NKI .. TN** d = 5 – 55 mm **NKI** d = 9 – 100 mm **NKIS** d = 15 – 65 mm **NA 49** d = 10 – 140 mm **NA 69** d = 12 – 95 mm **NA 48** d = 110 – 380 mm	Integral flanges, annular groove and one ore more lubrication holes (size dependent) If d ≤ 7 mm: with integral closure rings, without lubrication hole or annular groove NA 69 series bearings with an outside diameter D ≥ 52 mm are designed as double row bearings
With flanges, with an inner ring, sealed on one side		
	**NA 49.. RS** d = 10 – 50 mm	Integral flanges, annular groove and one or more lubrication holes (size dependent), factory greased
With flanges, with an inner ring, sealed on both sides		
	**NA 49...2RS** d = 10 – 50 mm	Integral flanges, annular groove and one or more lubrication holes (size dependent), factory greased

Bearing types

Bearing design Needle roller bearings with machined rings	Designation series Inside/bore diameter range	Characteristics
Without flanges, without an inner ring, not sealed		
	**RNA0 .. TN** F_w = 5 – 12 mm **RNA0** F_w = 15 – 100 mm	Available as single or double row bearings (→ product tables) Double row bearings have an annular groove and a lubrication hole
Without flanges, with an inner ring, not sealed		
	**NA0 .. TN** d = 6 – 9 mm **NA0** d = 12 – 90 mm	Available as single or double row bearings (→ product table) Double row bearings have an annular groove and a lubrication hole Some bearings have one lubrication hole in the inner ring (→ product table)

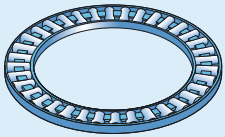
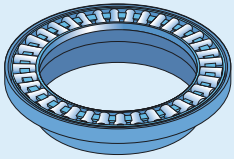
Alignment needle roller bearings

See chapter 5 starting on **page 141**

Bearing design Alignment needle roller bearings	Designation series Inside/bore diameter range	Characteristics
Without an inner ring		
	**RPNA** F_w = 15 – 45 mm	Can compensate static misalignment up to 3° between the shaft and housing Steel cage, not sealed, no lubrication holes
With an inner ring		
	**PNA** d = 12 - 40 mm	Can compensate static misalignment up to 3° between the shaft and housing Steel cage, not sealed, no lubrication holes

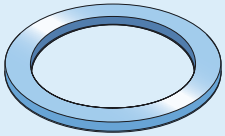
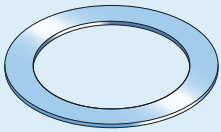
Needle roller thrust bearings

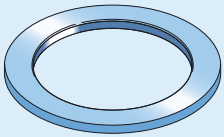
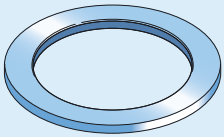
See chapter 6 starting on **page 151**

Bearing design Needle roller thrust bearings	**Designation series** Bore diameter range	**Characteristics**
Needle roller and cage thrust assemblies		
	**AXK .. TN** d = 4 – 8 mm **AXK** d = 10 – 160 mm	Appropriate washers: LS, AS, GS 811 and WS 811 series
Needle roller thrust bearings with a centring spigot		
	**AXW** d = 10 – 50 mm	Can be combined with radial needle roller bearings to accommodate combined radial and axial loads

Bearing washers

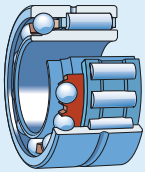
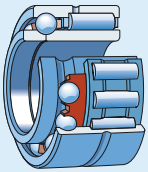
See chapter 6 on **page 154**

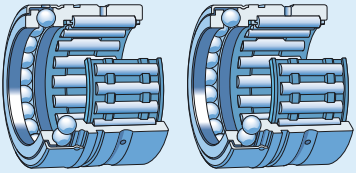
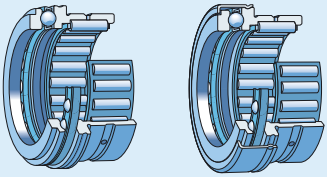
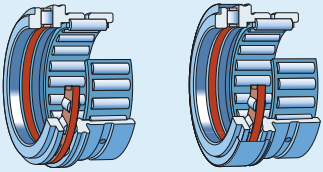
Bearing design Bearing washers	**Designation series** Bore diameter range	**Characteristics**
Raceway washers, LS series		
	**LS** d = 6 – 160 mm	Ground raceway, turned bore and outside diameter, can be combined with AXK and AXW series
Thrust washers, AS series		
	**AS** d = 4 – 160 mm	Made of spring steel, 1 mm thick, hardened and polished, can be combined with AXK and AXW series, both sides can be used as raceways

Bearing design Bearing washers	Designation series Bore/outside diameter range	Characteristics
Shaft washers, WS 811 series		
	**WS 811** d = 15 – 630 mm	Precision machined raceway, ground bore, can be combined with AXK and AXW series, for bore diameters up to 160 mm
Housing washers, GS 811 series		
	**GS 811** D = 28 – 750 mm	Precision machined raceway, ground outside diameter, can be combined with AXK series, for outside diameters up to 200 mm

Combined needle roller bearings

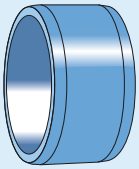
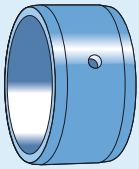
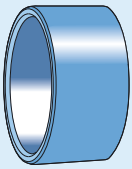
See chapter 7 starting on **page 169**

Bearing design Combined needle roller bearings	Designation series Bore diameter range	Characteristics
Needle roller / angular contact ball bearings, NKIA series		
	**NKIA** d = 12 – 70 mm	Can accommodate axial loads in one direction
Needle roller / angular contact ball bearings, NKIB series		
	**NKIB** d = 12 – 70 mm	Can accommodate axial loads in both directions

Bearing design Combined needle roller bearings	Designation series Inside diameter range	Characteristics
Needle roller / thrust ball bearings, NX series		
 NX series NX .. Z series	**NX .. (Z)TN** F_w = 7 mm **NX .. (Z)** F_w = 10 – 35 mm	Full complement thrust ball bearing, steel cover with or without lubrication holes NX .. Z series: factory greased thrust bearing, steel cover without lubrication hole
Needle roller / thrust ball bearings, NKX series		
 NKX series NKX .. Z series	**NKX .. (Z)TN** F_w = 10 mm **NKX .. (Z)** F_w = 12 – 70 mm	Thrust ball bearing with a cage, with or without steel cover NKX .. Z series: factory greased thrust bearing, steel cover without lubrication hole
Needle roller / cylindrical roller thrust bearings, NKXR series		
 NKXR series NKXR .. Z series	**NKXR** F_w = 15 – 50 mm **NKXR .. Z** F_w = 15 – 50 mm	Separable bearing design Thrust bearing with a steel cover and initial grease fill, non-separable bearing design

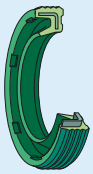
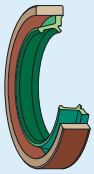
Needle roller bearing inner rings

See chapter 8 starting on **page 195**

Bearing design Needle roller bearing inner rings	Designation series Bore diameter range	Characteristics
 IR series  IR .. IS1 series	**IR** d = 5 – 380 mm **IR .. IS1** d = 6 – 50 mm	Made of carbon chromium bearing steel, hardened, precision machined raceway with a lead-in chamfer on both sides, with or without lubrication hole(s)
 LR series	**LR** d = 7 – 50 mm	Made of carbon chromium bearing steel, hardened, ground bore and raceway, turned side faces

Radial shaft seals with a low cross sectional height

See chapter 8 on **page 208**

Bearing design Radial shaft seals with a low cross sectional height	Designation series Bore diameter range	Characteristics
 G .. S series  G series		Single lip design, made of acrylonitrile-butadiene rubber
	G .. S d_1 = 4 – 7 mm	Rubber material metal cased
	G d_1 = 8 – 70 mm	Sheet steel reinforced
 SD design	**SD** d_1 = 8 – 50 mm	Double lip design, lips are made of polyurethane elastomer, polyamide reinforcement ring

Track runner bearings

SKF track runner bearings are rolling bearings with a very thick-walled outer ring that can accommodate heavy loads as well as shock loads. The designs of track runner bearings are based on ball bearings, needle roller bearings as well as cylindrical roller bearings.

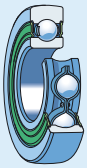
SKF supplies track runner bearings in many different designs and for a wide variety of operating conditions and applications. They are ready-to-mount pre-greased units and are intended for all types of cam drives, tracks, conveyor systems, etc. The rails used for SKF linear guides can serve as tracks for the bearings.

Basics of the SKF track runner bearing assortment are listed below and comprises the following types:

- cam rollers
- support rollers
- cam followers

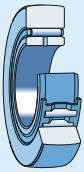
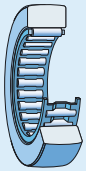
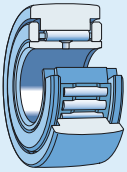
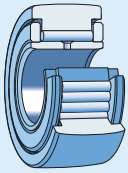
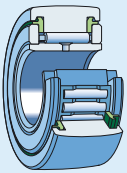
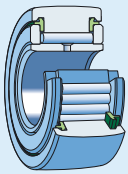
Cam rollers

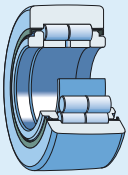
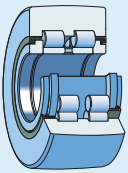
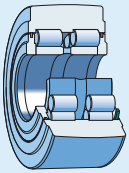
Not covered in this catalogue.
For additional information, refer to the *SKF Interactive Engineering Catalogue*.

Bearing design Cam rollers	**Designation series** Outside diameter range	**Characteristics**
Single row		
	**3612.. R** D = 32 – 80 mm	Sealed, crowned running surface
Double row		
 3058.. C-2Z series	**3058.. C-2Z** D = 32 – 80 mm	Sealed Crowned running surface
 3057.. C-2Z series	**3057.. C-2Z** D = 35 – 80 mm	Cylindrical running surface

Support rollers

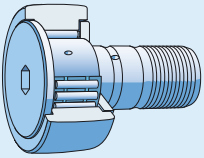
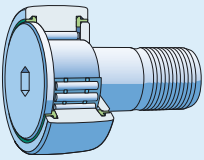
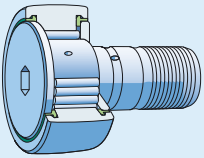
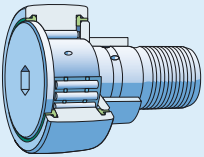
See chapter 9 starting on **page 215**

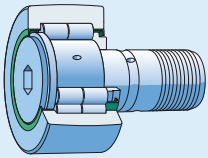
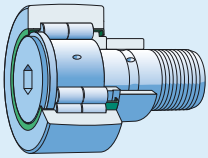
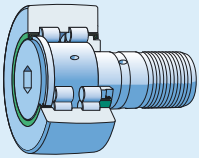
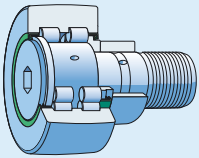
Bearing design Support rollers	**Designation series** Outside diameter range	**Characteristics**
Without flange rings, (R)STO and (R)NA 22...2RS designs		
 STO design	**STO .. TN** D = 19 – 24 mm **STO** D = 30 – 90 mm	Crowned running surface
 RSTO design	**RSTO .. TN** D = 16 – 24 mm **RSTO** D = 30 – 90 mm	
 NA 22...2RS design	**NA 22...2RS** D = 19 – 90 mm	
 RNA 22...2RS design	**RNA 22...2RS** D = 19 – 80 mm	
With flange rings, NATR and NATV designs		
 NATR design	**NATR** **NATV** D = 16 – 62 mm	Crowned running surface
 NATV design		
 NATR .. PPA series	**NATR .. PPA** **NATV .. PPA** D = 16 – 90 mm	Improved crowned running surface
 NATV .. PPA series		

Bearing design Support rollers	**Designation series** Outside diameter range	**Characteristics**
With flange rings, NUTR .. A design		
	**NUTR .. A** D = 35 – 110 mm	Can accommodate axial forces and heavy shock loads, improved crowned running surface
With flange rings, PWTR ...2RS design		
	**PWTR ...2RS** D = 35 – 110 mm	Improved crowned running surface
With flange rings, NNTR ...2ZL design		
	**NNTR ...2ZL** D = 130 – 310 mm	Size-dependent crowned running surface

Cam followers

See chapter 9 on **page 238**

Bearing design Cam followers	**Designation series** Outside diameter range	**Characteristics**
KR design		
 KR .. B series	**KR .. B** D = 22 – 40 mm **KR .. (PPSKA)** D = 16 – 19 mm **KR .. PPA** **KRV .. PPA** **KRE .. PPA** D = 16 – 90 mm	Crowned outer ring running surface as standard, designation suffixes PPSKA and PPA with an improved crowned profile, with or without axial sliding rings, cage-guided or full complement of needle rollers, concentric or eccentric seat, size-dependent characteristics regarding relubrication and holding during mounting
 KR .. PPSKA series		
 KRV .. PPA series		
 KRE .. PPA series		

Bearing design Cam followers	Designation series Outside diameter range	Characteristics
NUKR design		
 NUKR .. A design	**NUKR .. A** **NUKRE .. A** D = 35 – 90 mm	Improved crowned profile of the outer ring running surface, concentric seat or eccentric collar on the stud
 NUKRE .. A design		
PWKR design		
 PWKR ...2RS design	**PWKR ...2RS** **PWKRE ...2RS** D = 35 – 90 mm	Improved crowned profile of the outer ring running surface, concentric seat or eccentric collar on the stud
 PWKRE ...2RS design		

Bearing life and loads

Bearing life

The bearing size to be used can be selected on the basis of its load ratings in relation to the applied loads and the requirements regarding bearing life and reliability. A simple way to calculate bearing life is the classic ISO formula for basic rating life. However, SKF recommends using the SKF rating life, which makes predicting bearing life more reliable.

The values of the basic dynamic load rating C and the basic static load rating C_0 are listed in the product tables.

For additional information about the calculation methods and the equations, refer to the SKF *General Catalogue*. Calculations can also be performed easily online using the *SKF Interactive Engineering Catalogue*, available online at www.skf.com.

The general information about bearing life calculations and basic load ratings provided in the SKF *General Catalogue* and in the *SKF Interactive Engineering Catalogue* are also valid for needle roller bearings.

Equivalent bearing loads

Needle roller bearings can accommodate either radial loads (radial bearings) or axial loads (thrust bearings). Therefore, the equivalent bearing load P is equal to the calculated bearing load F and can be inserted directly into the life equations.

Combined needle roller bearings

The equation P = F is also valid for the radial and thrust bearing of combined needle roller bearings. It is necessary to calculate the life of the radial needle roller bearing and the thrust bearing separately.

For needle roller / angular contact ball bearings, the axial component of the load F_a must not exceed 25% of the radial component of the load F_r.

The values of the basic load ratings C for the radial and axial bearings are listed separately in the product tables.

Static bearing loads

The basic static load rating C_0 is used in calculations when the bearings are to:

- rotate at very slow speeds (n < 10 r/min)
- perform very slow oscillating movements
- be stationary under load for extended periods
- be under shock or heavy peak loads, whether it is rotating (dynamically stressed) or at rest

If one of these conditions exists, refer to the SKF *General Catalogue* (section *Selection of bearing size*).

Requisite minimum load

The correlation between load and service life is less important when bearings are subjected to very light loads, because the failure mode is typically something other than fatigue.

To achieve satisfactory operation, needle roller and track runner bearings must always be subjected to a requisite minimum load. Applying a requisite minimum load is especially important for bearings that operate at high speeds or are subjected to high accelerations or rapid changes in the direction of load. Under these conditions, not applying the correct minimum load can

result in damaging sliding movement between the rollers and raceways caused by the inertia forces of the needle rollers and cage and friction in the lubricant.

The requisite minimum radial and axial loads to be applied can be estimated for:

- radial needle roller bearings using

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

- needle roller thrust bearings using

$$F_{am} = 0{,}0005\ C_0$$

- track runner bearings using

$$F_{rm} = 0{,}0167\ C_0$$

The requisite minimum axial load for the thrust part of combined bearings can be obtained for:

- angular contact ball bearings using

$$F_{am} = 0{,}25\ \frac{C_0}{1\,000}\left(\frac{n\ d_m}{100\,000}\right)^2$$

- cylindrical roller thrust bearings using

$$F_{am} = 0{,}0005\ C_0 + A\left(\frac{n}{1\,000}\right)^2$$

- thrust ball bearings using

$$F_{am} = A\left(\frac{n}{1\,000}\right)^2$$

where
F_{rm} = minimum radial load [kN]
F_{am} = minimum axial load [kN]
C = basic dynamic load rating (→ product tables) [kN]
C_0 = basic static load rating (→ product tables) [kN]
d_m = mean bearing diameter = 0,5 (d + D) [mm]
n = rotational speed [r/min]
A = minimum load factor (→ product tables)

When starting up at low temperatures or when the lubricant is highly viscous, an even greater minimum load may be required. However, the weight of the components supported by the bearing, together with the external forces, generally exceeds the requisite minimum load. If this is not the case, the bearing must be subjected to an additional radial and/or axial load.

Friction

Friction in a bearing can be described as the resistance to rotation. The friction dictates the amount of heat generated within a bearing and consequently determines the bearing operating temperature. The amount of friction within a bearing depends on the load and several other factors including bearing type, size, operating speed, and the properties and quantity of the lubricant.

Friction in a bearing is produced in the contact areas. These are the areas where the rolling elements make contact with the raceways, cage(s), guiding surfaces and lubricant. If the bearing is sealed, the contact area also includes the area where the sealing lip makes contact with its counterface.

Estimating the frictional moment

The frictional moment can be calculated with sufficient accuracy under the following conditions:

- bearing load P ≈ 0,1 C
- good lubrication
- normal operating conditions

When using a coefficient of friction, the equations to be used are the following:

for radial needle roller bearings

$M = 0{,}5\ \mu\ P\ F_w$

and for other bearing types

$M = 0{,}5\ \mu\ P\ d$

Table 1

Coefficient of friction μ for bearings without seals, with a cage

Bearing type	Coefficient
Radial needle roller bearings	0,0022
Needle roller thrust bearings	0,0050
Thrust part of combined bearings	
Angular contact ball bearings	0,0020
Thrust ball bearings	0,0013
Cylindrical roller thrust bearings	0,0050

where

M = frictional moment [Nmm]
μ = coefficient of friction (→ **table 1**)
P = equivalent dynamic bearing load [N]
F_w = diameter under rollers [mm]
For needle roller bearings with an inner ring, the inner ring raceway diameter F is to be used.
d = bearing bore diameter [mm]

For additional information about calculating the frictional moment of needle roller bearings, refer to the SKF *General Catalogue*. Calculations can be easily performed online using the *SKF Interactive Engineering Catalogue*, available online at www.skf.com.

For information about calculating the frictional moment of track runner bearings, contact the SKF application engineering service.

Speeds

In the product tables, two speeds are typically listed: reference speed and limiting speed.

The reference speed represents the speed, under specific operating conditions, at which there is equilibrium between the heat that is generated by the bearing and the heat that is dissipated from the bearing via the shaft, housing and lubricant.

Limiting speed is determined by criteria that include the form stability or strength of the cage, lubrication of cage guiding surfaces, centrifugal and gyratory forces acting on the rolling elements, precision and other speed-limiting factors such as seals and lubricant for sealed bearings.

Which of these two speed values to consider depends on the needs of the application. In certain applications, such as very low speeds or oscillating movements, the speed limits are superseded in importance by other considerations.

For certain bearings, where the speed limit is not determined by heat from the rolling elements/raceway contacts, only limiting speeds are listed in the product tables. These include, for example, bearings with contact seals and all track runner bearings.

For additional information about speeds and calculations, refer to the SKF *General Catalogue* (section *Speeds and vibration*).

Bearing data – general

SKF needle roller bearings are manufactured to several specifications. These specifications, concerning tolerances and internal clearance, are described in the following sections. Information about each bearing type is provided in the introductory text of the individual product chapters.

Tolerances

Unless otherwise stated, the needle roller bearings listed in this catalogue are manufactured to dimensional, form and running accuracy of needle roller bearings in accordance with the following international standards:

- ISO 199:2005: Rolling bearings – Thrust bearings – Tolerances
- ISO 492:2002: Rolling bearings – Radial bearings – Tolerances

Information about the bearing types and the relevant tolerance classes are provided in the introductory text of the individual product chapters as well as tolerances for the inside diameter F_w of the roller set. Actual tolerance values are listed in **tables 2** to **5** on **pages 38** to **41**. The tolerance symbols used there are listed together with their definitions in **table 1**.

Table 1

Tolerance symbols

Symbol	Definition
	Bore diameter
d	Nominal bore diameter
d_{mp}	Mean bore diameter, arithmetical mean of the largest and smallest single bore diameters in one plane
Δ_{dmp}	Deviation of the mean bore diameter from the nominal ($\Delta_{dmp} = d_{mp} - d$)
V_{dp}	Bore diameter variation; difference between the largest and smallest single bore diameters in one plane
V_{dmp}	Mean bore diameter variation; difference between the largest and smallest mean bore diameter
	Outside diameter
D	Nominal outside diameter
D_{mp}	Mean outside diameter; arithmetical mean of the largest and smallest single outside diameters in one plane
Δ_{Dmp}	Deviation of the mean outside diameter from the nominal ($\Delta_{Dmp} = D_{mp} - D$)
V_{Dp}	Outside diameter variation; difference between the largest and smallest single outside diameters in one plane
V_{Dmp}	Mean outside diameter variation; difference between the largest and smallest mean outside diameters of one ring or washer
	Width or height
B_s, C_s	Single width of the inner ring and outer ring, respectively
Δ_{Bs}, Δ_{Cs}	Deviation of the single inner ring width or single outer ring width from the nominal ($\Delta_{Bs} = B_s - B$; $\Delta_{Cs} = C_s - C$)
V_{Bs}, V_{Cs}	Ring width variation; difference between the largest and smallest single widths of the inner ring and of the outer ring, respectively
T_S	Single height (H) of a single direction thrust bearing
Δ_{Ts}	Deviation of the single height of a thrust bearing from the nominal ($\Delta_{Ts} = T_S - T$)
	Running accuracy
K_{ia}, K_{ea}	Radial runout of the inner ring and outer ring, respectively, of an assembled bearing
S_d	Side face runout with reference to the bore (of an inner ring)
S_D	Outside inclination variation; variation in inclination of an outside cylindrical surface to an outer ring side face
S_i, S_e	Thickness variation, measured from the middle of the raceway to the back (seat) face of the shaft washer and of the housing washer, respectively (axial runout)

Table 2

Normal tolerances for radial needle roller bearings and track runner bearings

Inner ring

$d^{1)}$ over	incl.	Δ_{dmp} high	low	V_{dp} max	V_{dmp} max	Δ_{Bs} high	low	V_{Bs} max	K_{ia} max
mm		µm		µm	µm	µm		µm	µm
2,5	**10**	0	–8	10	6	0	–120	15	10
10	**18**	0	–8	10	6	0	–120	20	10
18	**30**	0	–10	13	8	0	–120	20	13
30	**50**	0	–12	15	9	0	–120	20	15
50	**80**	0	–15	19	11	0	–150	25	20
80	**120**	0	–20	25	15	0	–200	25	25
120	**180**	0	–25	31	19	0	–250	30	30
180	**250**	0	–30	38	23	0	–300	30	40
250	**315**	0	–35	44	26	0	–350	35	50
315	**400**	0	–40	50	30	0	–400	40	60

[1)] For cam followers the stud shank diameter d can be used as the bore diameter reference.

Outer ring

D over	incl.	Δ_{Dmp} high	low	V_{Dp} max	V_{DMp} max	Δ_{Cs}, V_{Cs}	K_{ea} max
mm		µm		µm	µm		µm
6	**18**	0	–8	10	6	Values are	15
18	**30**	0	–9	12	7	identical to	15
30	**50**	0	–11	14	8	those for inner ring	20
50	**80**	0	–13	16	10	of same	25
80	**120**	0	–15	19	11	bearing	35
120	**150**	0	–18	23	14	(Δ_{Bs}, V_{Bs})	40
150	**180**	0	–25	31	19		45
180	**250**	0	–30	38	23		50
250	**315**	0	–35	44	26		60
315	**400**	0	–40	50	30		70
400	**500**	0	–45	56	34		80

Class P6 tolerances for radial bearings

Inner ring

d over	d incl.	Δ_{dmp} high	Δ_{dmp} low	V_{dp} max	V_{dmp} max	Δ_{Bs} high	Δ_{Bs} low	V_{Bs} max	K_{ia} max
mm		µm		µm	µm	µm		µm	µm
2,5	**10**	0	–7	9	5	0	–120	15	6
10	**18**	0	–7	9	5	0	–120	20	7
18	**30**	0	–8	10	6	0	–120	20	8
30	**50**	0	–10	13	8	0	–120	20	10
50	**80**	0	–12	15	9	0	–150	25	10
80	**120**	0	–15	19	11	0	–200	25	13
120	**180**	0	–18	23	14	0	–250	30	18
180	**250**	0	–22	28	17	0	–300	30	20
250	**315**	0	–25	31	19	0	–350	35	25
315	**400**	0	–30	38	23	0	–400	40	30

Outer ring

D over	D incl.	Δ_{Dmp} high	Δ_{Dmp} low	V_{Dp} max	V_{Dmp} max	Δ_{Cs}, V_{Cs}	K_{ea} max
mm		µm		µm	µm		µm
6	**18**	0	–7	9	5	Values are	8
18	**30**	0	–8	10	6	identical to	9
30	**50**	0	–9	11	7	those for inner ring	10
50	**80**	0	–11	14	8	of same	13
80	**120**	0	–13	16	10	bearing	18
120	**150**	0	–15	19	11	(Δ_{Bs}, V_{Bs})	20
150	**180**	0	–18	23	14		23
180	**250**	0	–20	25	15		25
250	**315**	0	–25	31	19		30
315	**400**	0	–28	35	21		35
400	**500**	0	–33	41	25		40

Table 4

Class P5 tolerances for radial bearings

Inner ring

d over	d incl.	Δ_{dmp} high	Δ_{dmp} low	V_{dp} max	V_{dmp} max	Δ_{Bs} high	Δ_{Bs} low	V_{Bs} max	K_{ia} max	S_d max
mm		µm		µm	µm	µm		µm	µm	µm
2,5	**10**	0	–5	5	3	0	–40	5	4	7
10	**18**	0	–5	5	3	0	–80	5	4	7
18	**30**	0	–6	6	3	0	–120	5	4	8
30	**50**	0	–8	8	4	0	–120	5	5	8
50	**80**	0	–9	9	5	0	–150	6	5	8
80	**120**	0	–10	10	5	0	–200	7	6	9
120	**180**	0	–13	13	7	0	–250	8	8	10
180	**250**	0	–15	15	8	0	–300	10	10	11
250	**315**	0	–18	18	9	0	–350	13	13	13
315	**400**	0	–23	23	12	0	–400	15	15	15

Outer ring

D over	D incl.	Δ_{Dmp} high	Δ_{Dmp} low	V_{Dp} max	V_{Dmp} max	Δ_{Cs}	V_{Cs} max	K_{ea} max	S_D max
mm		µm		µm	µm		µm	µm	µm
6	**18**	0	–5	5	3	Values are	5	5	8
18	**30**	0	–6	6	3	identical to	5	6	8
30	**50**	0	–7	7	4	those for inner ring	5	7	8
50	**80**	0	–9	9	5	of same	6	8	8
80	**120**	0	–10	10	5	bearing	8	10	9
120	**150**	0	–11	11	6	(Δ_{Bs}, V_{Bs})	8	11	10
150	**180**	0	–13	13	7		8	13	10
180	**250**	0	–15	15	8		10	15	11
250	**315**	0	–18	18	9		11	18	13
315	**400**	0	–20	20	10		13	20	13
400	**500**	0	–23	23	12		15	23	15

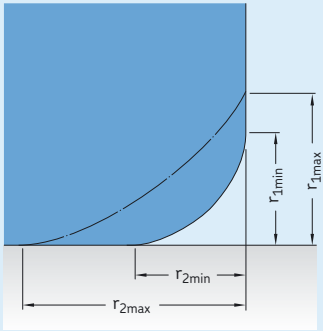
Limits for chamfer dimensions

Minimum values for the chamfer dimensions are listed in the product tables. To prevent the improper dimensioning of fillets on associated components for needle roller bearings and to facilitate the calculation of snap ring location arrangements, the maximum chamfer limits for the relevant minimum value of chamfer dimensions are listed in **table 6**. These limits are in accordance with ISO 582:1995. The symbols used are explained below:

- d nominal bearing bore diameter
- r_1 maximum value in the radial direction
- r_2 maximum value in the axial direction
- $r_{s\,min}$ general symbol for the minimum value of chamfer dimensions

Table 6

Chamfer dimension limits



Minimum value	Nominal bearing bore diameter		Maximum values Radial bearings		Thrust bearings
$r_{s\,min}$	d over	incl.	r_1 max	r_2 max	$r_{1,2}$ max
mm	mm		mm		
0,1	–	–	0,2	0,4	0,2
0,15	–	–	0,3	0,6	0,3
0,2	–	–	0,5	0,8	0,5
0,3	–	40	0,6	1	0,8
	40	–	0,8	1	0,8
0,6	–	40	1	2	1,5
	40	–	1,3	2	1,5
1	–	50	1,5	3	2,2
	50	–	1,9	3	2,2
1,1	–	120	2	3,5	2,7
	120	–	2,5	4	2,7
1,5	–	120	2,3	4	3,5
	120	–	3	5	3,5
2	–	80	3	4,5	4
	80	220	3,5	5	4
	220	–	3,8	6	4
2,1	–	280	4	6,5	4,5
	280	–	4,5	7	4,5

Table 5

Normal tolerance class for washers and thrust bearings

Shaft washer, WS

d		Δ_{dmp}		V_{dp}	S_i[1]	Δ_{Ts}[1]	
over	incl.	high	low	max	max	high	low
mm		µm		µm	µm	µm	
–	**18**	0	–8	6	10	+20	–250
18	**30**	0	–10	8	10	+20	–250
30	**50**	0	–12	9	10	+20	–250
50	**80**	0	–15	11	10	+20	–250
80	**120**	0	–20	15	15	+25	–300
120	**180**	0	–25	19	15	+25	–300

Housing washer, GS

d		Δ_{dmp}		V_{Dp}	S_e
over	incl.	high	low	max	
mm		µm		µm	µm
18	**30**	0	–13	10	10
30	**50**	0	–16	12	10
50	**80**	0	–19	14	10
80	**120**	0	–19	14	10
120	**180**	0	–25	19	15
180	**250**	0	–30	23	20

[1] Also valid where raceway washers in the LS series are used

Internal clearance

Bearing internal clearance is defined as the total distance through which one bearing ring can be moved relative to the other in the radial direction (radial internal clearance) or in the axial direction (axial internal clearance).

It is necessary to distinguish between the internal clearance in a bearing before mounting and the internal clearance in a mounted bearing that has reached its operating temperature (operational clearance). The initial internal clearance (before mounting) is greater than the operational clearance because the degree of the interference fits and the effects of thermal expansion of the bearing rings and associated components will expand or compress the rings.

Bearing internal clearance referred to as Normal has been selected so that a suitable operational clearance will be obtained when the bearing is mounted with the recommended fits and operating under normal conditions. In applications where conditions are not normal, e.g. where interference fits are used for both bearing rings, unusual temperatures prevail, or bearings with greater or smaller internal clearance than Normal are required, SKF recommends checking residual clearance in the bearing after it has been mounted.

Unless otherwise stated, SKF needle roller bearings with an inner ring have Normal radial internal clearance. Bearings having an internal clearance other than Normal are identified by the designation suffix C2, C3 or C4. The clearance values (→ **table 7**) are in accordance with ISO 5753:1991 and are valid for unmounted bearings under zero measuring load.

Table 7

Radial internal clearance for needle roller bearings and track runner bearings

Bore diameter d[1]		Radial internal clearance							
		C2		Normal		C3		C4	
over	incl.	min	max	min	max	min	max	min	max
mm		µm							
–	30	0	25	20	45	35	60	50	75
30	40	5	30	25	50	45	70	60	85
40	50	5	35	30	60	50	80	70	100
50	65	10	40	40	70	60	90	80	110
65	80	10	45	40	75	65	100	90	125
80	100	15	50	50	85	75	110	105	140
100	120	15	55	50	90	85	125	125	165
120	140	15	60	60	105	100	145	145	190
140	160	20	70	70	120	115	165	165	215
160	180	25	75	75	125	120	170	170	220
180	200	35	90	90	145	140	195	195	250
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

[1] For cam followers, the stud shank diameter d can be used as the bore diameter reference.

Cages

Bearing cages can influence the suitability of a rolling bearing for a particular application. Their main purposes are:

- to separate the rolling elements and keep them spaced evenly for uniform load distribution
- to reduce noise levels
- to guide the rolling elements in the unloaded zone to improve rolling conditions and prevent damaging sliding movements
- to retain the rolling elements when mounting separable bearings

Cages are stressed by friction, inertia forces and heat. Depending on the material, cages can also be affected by certain lubricants, lubricant additives, organic solvents, coolants, or by-products of these substances as they age. Therefore, cage design and material are of paramount importance for the performance and the operational reliability of the bearing.

For larger bearings, the standard cage may be different than the one used in smaller bearings even though they are in the same design or series. In the introductory text of each product chapter, information is provided about standard cages.

Seals

The seals integrated in a needle roller bearing can have a considerable impact on the performance and reliability of the bearing. Their primary purpose is to exclude solid contaminants and moisture and retain the lubricant in the bearing. The seal materials must withstand oxidation and offer excellent thermal or chemical resistance. Integral seals are generally contact seals or sliding rings.

Depending on the internal geometry and design of the bearing, the arrangement of the bearing and associated components can form non-contact seals and act as efficient labyrinth or gap-type seals.

Additional information about seals is available in the introductory text of each product chapter, if seals are available.

In addition to integral bearing seals, SKF also supplies an assortment of radial shaft seals that can be used as external seals. Appropriate seals are listed in the product tables, if available. For additional information, refer to the section *Radial shaft seals with a low cross sectional height*, starting on **page 208**.

Materials

The material used to make a bearing component determines, to a large extent, the performance and reliability of that bearing. For the bearing rings and rolling elements, typical considerations include hardness for load carrying capacity, fatigue resistance under rolling contact conditions, under clean or contaminated lubrication conditions, and the dimensional stability of the bearing components.

For additional information about seal materials, refer to the SKF *General Catalogue*. The general information about materials also applies to needle roller bearings.

Materials for bearing rings and rolling elements

The standard steel used to produce machined rings and rolling elements of SKF needle roller bearings is a carbon chromium steel for through-hardening, containing approximately 1% carbon and 1,5% chromium, in accordance with ISO 683:17:1999.

Unless otherwise stated in the product chapters, bearing washers are also made of this carbon chromium bearing steel.

The thin-walled deep drawn outer rings of drawn cup needle roller bearings and the drawn sheet steel sleeve of alignment needle roller bearings are exceptions. They are made of mild steel in accordance with EN 10139:1997.

The majority of outer rings of track runner bearings are made of bearing steels for case-hardening because of their ability to withstand heavy shock loads. Materials that can be used are chromium-nickel and manganese-chromium alloyed steel in accordance with ISO 683-17:1999.

Standard needle roller bearings and track runner bearings made of carbon chromium steel or steel for case hardening are heat stabilized up to 120 °C unless otherwise stated in the introductory text of the product chapter. Bearings used in applications where temperatures exceed 120 °C must be subjected to a special heat stabilization process to provide adequate dimensional stability.

Cage materials

Polyamide 66

Polyamide 66, with glass fibre reinforcement, is used for cages in many needle roller bearings and thrust bearings. Polyamide 66 is characterized by a favourable combination of strength and elasticity.

Due to its excellent sliding properties on lubricated steel surfaces and the superior finish of the contact surfaces, polyamide 66 cages promote low friction, low heat generation and low wear.

Polyamide 66 can be used for operating temperatures ranging from –40 to +120 °C, provided it does not come in contact with aggressive lubricants. Aggressive lubricants (e.g. oils with EP additives or some synthetic oils) promote ageing effects that can be compensated for by reducing the normal operating temperature. At temperatures below –40 °C, polyamide loses its elasticity, which can result in cage failures. For additional information about the cage material, particularly the relationship between the operating temperatures and the cage ageing life, refer to the SKF *General Catalogue*.

Steel cages

Steel cages can be used at operating temperatures up to 300 °C. They are not affected either by mineral or synthetic oil-based lubricants or by the organic solvents used to clean a bearing. They are designed as window-type cage.

Sheet steel cages are pressed from continuously hot-rolled low carbon steel. These lightweight cages have relatively high strength and can be surface treated to further reduce friction and wear.

Machined steel cages are made of non-alloyed structural steel. To improve sliding and wear-resistance, some machined steel cages are surface treated.

Seal materials

Acrylonitrile-butadiene rubber (NBR)

Acrylonitrile-butadiene rubber (NBR) is the "universal" seal material. This copolymer, produced from acrylonitrile and butadiene, shows good resistance to the following media:

- most mineral oils and greases with a mineral oil base
- normal fuels: petrol, diesel and light heating oils
- animal and vegetable oils and fats
- hot water

NBR also tolerates short-term dry running of the sealing lip. The permissible operating temperature range is –40 to +100 °C. For brief periods, temperatures of up to 120 °C can be tolerated. At higher temperatures, the material hardens.

Polyurethane

Polyurethane (AU) is a wear-resistant organic material with good elastic properties. It is resistant to mineral oil based greases and lubricating oils, even those containing small quantities of EP (Extreme Pressure) additives. The permissible operating temperature range is –30 to +100 °C.

Fluoro rubber

Fluoro rubbers (FKM) are characterized by their high thermal and chemical resistance. Their resistance to ageing and ozone is very good and their gas permeability is very slight. They have exceptionally good wear characteristics even under harsh environmental conditions and can withstand operating temperatures up to 200 °C. Seals made from this material can tolerate dry running of the lip for short periods.

Fluoro rubbers are also resistant to oils and hydraulic fluids, fuels and lubricants, mineral acids and aliphatic, as well as aromatic hydrocarbons, which would cause seals made from other materials to fail. In the presence of esters, ethers, ketones, certain amines and hot anhydrous hydrofluorides, fluoro rubbers should not be used.

Note

At temperatures above 300 °C, fluoro rubber gives off dangerous fumes. As handling seals made of fluoro rubber constitutes a potential safety risk, the safety precautions mentioned hereafter must always be followed.

WARNING!

Safety precautions for fluoro rubber
Fluoro rubber is very stable under normal operating conditions up to 200 °C. At temperatures above 200 °C, the material hardens and loses its effectiveness.

At temperatures above 300 °C, which is usually the result of a fire or the flame of a cutting torch, fluoro rubber seals will give off hazardous fumes which can be harmful to the eyes and, if inhaled, to the respiratory system.

Once fluoro rubber has been heated to 300 °C or above, it is dangerous to handle, **even after it has cooled**. Therefore, the following safety precautions should be observed when handling such material:

- Always wear protective goggles, gloves and appropriate breathing apparatus.
- Place the remains of the seals in an airtight plastic container marked with a symbol for “material will etch”.
- Follow the safety precautions in the appropriate material safety data sheet (MSDS).

Anyone who contacts these seals or their remains should wash their hands with soap and plenty of water and flush eyes with plenty of water and consult a doctor immediately. If the fumes have been inhaled, they should consult a doctor immediately.

The user is responsible for the correct use of the product during its service life and its proper disposal.

Supplementary designations

The complete designation for needle roller and track runner bearings consists of a basic designation, which identifies bearing type and size, as well as supplementary designations. These designation suffixes identify design features that differ from the standard design. Where several supplementary designations are used to identify a particular bearing, they are always written in a specific order. The supplementary designations listed below are not exhaustive, but include those most commonly used.

Suffix	Description
A	NUTR design support rollers and NUKR design cam followers with an improved crowned profile of the outer ring running surface
AS..	Lubrication hole(s) in the outer ring, a figure following indicates the number of holes
ASR..	Annular groove and lubrication hole(s) in the outer ring, a figure following indicates the number of holes
B	KR design cam followers with a crowned profile of the outer ring running surface and a recessed hexagon on both ends of the stud
BF	Needle roller with flat ends
C2	Bearing internal clearance smaller than Normal
C3	Bearing internal clearance greater than Normal
CN	Bearing internal clearance Normal, only used together with an additional letter (H, L, M, P) that identifies a reduced or displaced clearance range
C4	Bearing internal clearance greater than C3
D	Deviating or modified internal design with the same boundary dimensions. Generally dropped after a certain changeover period, but may have the significance to bound to the particular bearing design/series Example: K 40×45×17 D Needle roller and cage assembly with a double split cage
DS	Single split needle roller and cage assembly
EGS	Inner ring with a non-directionally ground raceway
G2	Needle roller in accordance with ISO 3096:1996 Grade 2
H..	Needle roller bearing without an inner ring, with reduced inside diameter (under rollers) tolerance, followed by tolerance limits in µm, e.g. H+27+20
IS..	Needle roller bearing with one or more lubricating holes in the inner ring, a figure following indicates the number of holes
ISR..	Needle roller bearing with an annular groove and one or more lubricating holes in the inner ring, a figure following indicates the number of holes
M../M..	Diameter tolerance of needle rollers, e.g. M2/M4 indicates diameter tolerance –2 to –4 µm
N/M..	Diameter tolerance of needle rollers, e.g. N/M2 indicates diameter tolerance 0 to –2 µm
P5	Dimensional and running accuracies to ISO tolerance class 5
P6	Dimensional and running accuracies to ISO tolerance class 6
P6CNR	P6 + CNR
P62	P6 + C2
P63	P6 + C3
PPA	1. NATR or NATV design support rollers with a polyamide 66 axial sliding and sealing ring on both sides. Improved crowned profile of the outer ring running surface. 2. KR design cam followers have the same features as listed above. Sizes 16 and 19 have one slot in the head of the stud as standard. Size 22 and larger have a recessed hexagon on both ends.
PPSKA	KR design cam followers, sizes 16 and 19, with a polyamide 66 axial sliding and sealing ring on both sides, improved crowned profile of the outer ring running surface and a hexagon recessed into the head of the stud. These cannot be relubricated.
PPXA	Cam followers with PPA features except for the outer ring running surface, which has a cylindrical profile
RS	Contact seal of acrylonitrile-butadiene rubber (NRB) with or without sheet steel reinforcement on one side of the bearing

.2RS RS contact seal on both sides of the bearing

..S Matched bearings for an equal distribution of the radial load. The figure preceding indicates the number of bearings, e.g. NK 50/25 TN/2S

S Radial shaft seals with low cross sectional height, rubber material is metal cased, e.g. G 6×12×2 S

2S Two matched bearings for an equal distribution of radial load (refer to S, the figure preceding the S indicates the number of bearings)

S0 Bearing rings or washers dimensionally stabilized for use at operating temperatures up to 150 °C

S1 Bearing rings or washers dimensionally stabilized for use at operating temperatures up to 200 °C

S2 Bearing rings or washers dimensionally stabilized for use at operating temperatures up to 250 °C

S3 Bearing rings or washers dimensionally stabilized for use at operating temperatures up to 300 °C

SM.. Special grease, two figures following identify the grease

/SORT.. Tolerance grade of needle rollers of a needle roller and cage assembly, the figures following give the actual limits in µm, e.g. /SORT-2-4

TN Injection moulded cage of polyamide 66 with glass fibre reinforcement

VGS Inner ring with a pre-ground raceway and a machining allowance

VG052 Single split cage of polyethersulfone (PES)

X Track runner bearings with a cylindrical (flat) profile of the outer ring running surface

XA NUKR .. A and NUKRE .. A design cam followers with a cylindrical (flat) profile of the outer ring running surface

Z Combined needle roller bearings, axial bearing with a cover over the outside diameter without lubrication holes. Filled at the factory with a high-quality lithium base NLGI 2 grease.

ZW Double row needle roller and cage assembly

.2ZL Support rollers with a lamellar seal on both sides

Application of bearings

The bearing arrangement of a rotating machine component such as a shaft generally requires locating and a non-locating bearing arrangement to support and locate the component radially and axially relative to the housing. As radial needle roller bearings can accommodate axial displacement within the bearing, they generally are used as non-locating bearings.

Needle roller thrust bearings can only accommodate axial loads acting in one direction. A double direction needle roller thrust bearing can be created by combining two needle roller and cage thrust assemblies and bearing washers with an intermediate washer. Radial loads must be accommodated by a combined needle roller bearing or a separate radial bearing.

Combined needle roller bearings can accommodate radial loads and axial loads in one direction only. Therefore, a second combined needle roller bearing is required to be able to take axial loads in the opposite direction (except NKIB series needle roller bearings that can accommodate axial loads in both directions).

For additional information about bearing arrangements, refer to the SKF *General Catalogue*. The application information for bearings provided in the SKF *General Catalogue* is also valid for needle roller bearings.

If necessary, the introductory text of each product chapter provides information about

- axial guidance
- axial and radial location
- recommended fits for shafts and housings

Design of associated components

Form and running accuracy

Good running accuracy, required speeds and low operating temperatures can only be achieved if the associated components and other mating parts are manufactured with equal precision as the needle roller bearings. Deviations from geometric form of associated seats and abutments must be kept to a minimum. The parts should be machined according to the following recommendations.

Table 1

Limits for ISO tolerance grades

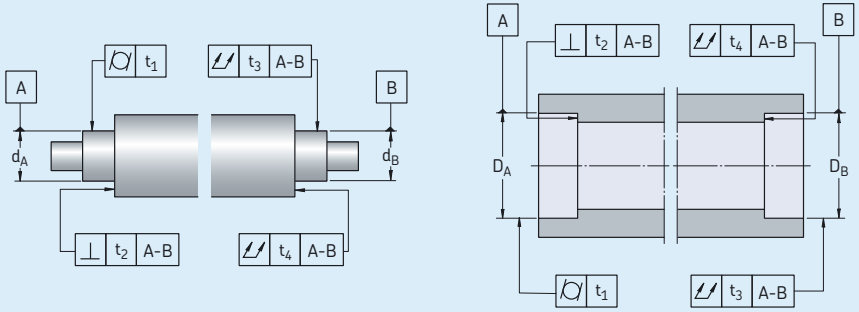
Nominal dimension		Tolerance grades					
over	incl.	IT2	IT3	IT4	IT5	IT6	IT7
		max					
mm		µm					
1	**3**	1,2	2	3	4	6	10
3	**6**	1,5	2,5	4	5	8	12
6	**10**	1,5	2,5	4	6	9	15
10	**18**	2	3	5	8	11	18
18	**30**	2,5	4	6	9	13	21
30	**50**	2,5	4	7	11	16	25
50	**80**	3	5	8	13	19	30
80	**120**	4	6	10	15	22	35
120	**180**	5	8	12	18	25	40
180	**250**	7	10	14	20	29	46
250	**315**	8	12	16	23	32	52
315	**400**	9	13	18	25	36	57
400	**500**	10	15	20	27	40	63

Dimensional tolerances

For bearings manufactured to Normal tolerances, the dimensional accuracy of cylindrical seats on the shaft should be at least grade 6 and in the housing at least grade 7. For bearings with higher accuracy, correspondingly better grades should be used. The numerical values of standard IT tolerance grades, in accordance with ISO 286-1:1988, are listed in **table 1**.

Table 2

Accuracy of form and position for bearing seats on shafts and in housings



Surface Characteristic	Symbol for characteristic	tolerance zone	Permissible deviation Bearings of tolerance class[1] Normal	P6	P5
Cylindrical seat					
Cylindricity	⌭	t_1	$\frac{IT5}{2}$	$\frac{IT4}{2}$	$\frac{IT3}{2}$
Total radial runout	↗	t_3	$\frac{IT5}{2}$	$\frac{IT4}{2}$	$\frac{IT3}{2}$
Flat abutment					
Perpendicularity	⊥	t_2	IT5	IT4	IT3
Total axial runout	↗	t_4	IT5	IT4	IT3

[1] The basic tolerance classes stated are valid for normal demands on the bearing arrangement. For special demands in respect of running accuracy or even support, the bearing seat should be machined to the basic tolerance classes recommended for the next higher bearing tolerance class.

Tolerances for cylindrical form

The cylindricity tolerances as defined in ISO 1101-2004 should be one to two IT grades better than the prescribed dimensional tolerance, depending on requirements. For example, if a bearing shaft seat has been manufactured to m6 tolerance class, then the accuracy of form should be to IT5 or IT4 tolerance grade. The tolerance value for cylindricity, t_1, is obtained for an assumed shaft diameter of 150 mm from t_1 = IT5/2 = 18/2 = 9 µm. However, the tolerance t_1 is for a radius, hence 2 t_1 applies for the shaft diameter. Guideline values for the cylindrical form tolerance and the total runout tolerance for the different bearing tolerance classes are listed in **table 2** on **page 49**.

Tolerances for perpendicularity

Abutments for bearing rings should have a rectangularity tolerance as defined in ISO 1101-2004, which is better by at least one IT grade than the diameter tolerance of the associated cylindrical seat. For thrust bearing washer seats, the tolerance for perpendicularity should not exceed IT5 tolerance grade. Guideline values for the tolerance for rectangularity and for the total axial runout are listed in **table 2** on **page 49**.

Surface roughness of bearing seats

The surface roughness of a bearing seat does not have the same degree of influence on bearing performance as the dimensional, form and running accuracies. However, the accuracy of an interference fit is directly proportional to the smoothness of the mating surface.

For bearing arrangements where accuracy is a key operational parameter, guideline values for the mean surface roughness R_a are listed in **table 3**. These recommendations apply to ground seats, which are normally assumed for shaft seats.

Raceways on shafts and in housings

Raceway hardness and its influence

If the load carrying capacity of the bearing or assembly is to be fully exploited, the raceways machined in associated components must be hardened to between 58 and 64 HRC.

Raceway surface finish and accuracy

The surface roughness should be $R_a \leq 0{,}2$ µm or $R_z \leq 1$ µm. For less demanding applications, rougher surfaces may be used.

The out-of-round and deviation from cylindrical form must not exceed 25 and 50%, respectively, of the actual diameter tolerance of the raceway.

The permissible axial runouts of raceways for thrust assemblies are the same as for the shaft and housing washers of thrust bearings, listed in **table 5** on **page 41**.

Raceway materials

Suitable materials for the raceways include steel for through-hardening, e.g. 100Cr6 in accordance with ISO 683-17:1999, steels for case-hardening, e.g. 20Cr3 or 17MnCr5 in accordance with ISO 683-17:1999) as well as steels for induction-hardening that can be surface hardened.

Table 3

Guideline values for surface roughness of bearing seats

Diameter of seat d (D)		**Recommended R_a value for ground seats** Diameter tolerance to		
over	incl.	IT7	IT6	IT5
mm		µm		
–	**80**	1,6 (N7)	0,8 (N6)	0,4 (N5)
80	**500**	1,6 (N7)	1,6 (N7)	0,8 (N6)

The recommended hardening depth for raceways machined in associated components depends on various factors including the dynamic and static load ratios (P/C and P_0/C_0 respectively) as well as the core hardness of the component. Therefore, it is difficult to make generalizations regarding hardening depth. For example, under conditions of purely static load up to the magnitude of the basic static load rating and with a core hardness of 350 HV, the recommended hardening depth is in the order of 0,1 times the rolling element diameter. For dynamic loads, however, smaller hardening depths are permitted. For additional information, contact the SKF application engineering service.

Lubrication

If rolling bearings are to operate reliably they must be adequately lubricated to prevent direct metal-to-metal contact between the rolling elements, raceways and cages. The lubricant also inhibits wear and protects the bearing surfaces against corrosion. The choice of a suitable lubricant and method of lubrication for each individual bearing application is therefore important, as is adequate maintenance.

Differences in the lubricating properties of seemingly identical lubricants – particularly grease – produced at different locations can exist. As a result, SKF will not accept responsibility for the performance of any of its lubricants. The user is therefore advised to specify lubricant properties in detail so as to obtain the most suitable lubricant for the application.

The SKF traffic light concept

Most grease suppliers indicate the specific values for the low and high temperature limits in their product information. The SKF traffic light concept is distinctly different from that. SKF recognizes that the really important temperatures for reliable operation lie within a smaller range. This range depends largely on the type of base oil and thickener used, as well as the additives. The relevant temperatures are given by the SKF traffic light concept. They are schematically illustrated in **diagram 1** in the form of a double traffic light.

It is clear that grease in the red zones should not be applied at all, as damage may occur. Within the green zone, the grease will function reliably and the grease life can be determined accurately.

At temperatures in the amber zone above the high temperature performance limit (HTPL), grease will age and oxidize with increasing rapidity and the by-products of the oxidation will have a detrimental effect on lubrication. An amber zone also exists for low temperatures. Short periods in this zone such as during a cold start are not harmful since the heat caused by friction will bring the bearing temperature into the green zone.

For additional information about the SKF traffic light concept, refer to the SKF *General Catalogue* (section *Lubrication*).

Lubricating greases

The following explains basics concerning initial grease fills, if available, and gives recommendations for SKF greases that can be used for relubrication. Certain features, which facilitate efficient lubrication and relubrication of the bearings are provided in the introductory text of the individual product chapters.

For additional information about lubrication and calculation of relubrication intervals, refer to the SKF *General Catalogue* (section *Lubrication*). The SKF grease selection program *Lube Select* available online at www.aptitudeexchange.com provides a more detailed selection of appropriate greases.

Initial grease fill

Sealed needle roller bearings and track runner bearings

The following bearings are filled at the factory with the same high-quality grease with good corrosion inhibiting properties:

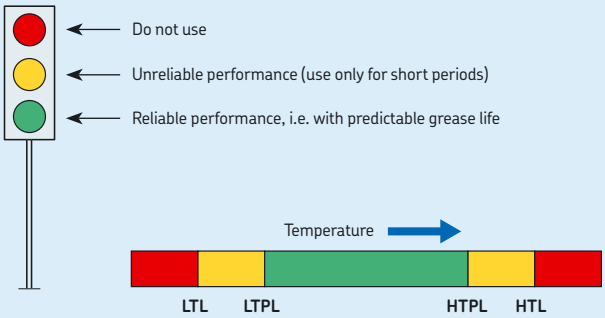
- sealed needle roller bearings
- thrust part of combined bearings with the designation suffix Z
- cam followers
- support rollers

SKF recommends SKF LGWA 2 grease, if relubrication is required.

The most important technical specifications for grease for initial fill and for relubrication are listed in **table 1** on **page 54**.

Diagram 1

The SKF traffic light concept – general



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

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

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

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

Full complement drawn cup needle roller bearings

Special grease is used for full complement drawn cup needle roller bearings to secure the rollers during transportation. However, this grease does not provide sufficient long term lubrication. Therefore, relubrication after mounting may be necessary. Depending on the required consistency class, SKF recommends SKF LGEP 2 or SKF LGMW 1 greases for relubrication. Characteristics for the greases are listed in **table 2**.

Table 1

Lubricating greases for sealed needle roller bearings and track runner bearings

	Initial grease fill	LGWA 2
Thickener	Lithium complex soap	Lithium complex soap
Base oil type	Mineral	Mineral
NLGI consistency class	2	2
Temperature range[1] [°C]	–25 20 130 250	–30 50 140 220
[°F]	–15 70 265 480	–20 120 285 430
Base oil viscosity [mm²/s]		
at 40 °C	160	185
at 100 °C	15,5	15

[1] Refer to the SKF traffic light concept.

Table 2

Greases for full complement drawn cup needle roller bearings

	Initial grease fill	LGEP 2	LGMW 1
Thickener	Lithium soap	Lithium soap	Lithium soap
Base oil type	Mineral	Mineral	Mineral
NLGI consistency class	1 – 2	2	1
Temperature range[1] [°C]	–30 20 120 180	–20 40 110 180	–30 10 110 180
[°F]	–20 70 250 355	–5 105 230 355	–20 50 230 355
Base oil viscosity [mm²/s]			
at 40 °C	200	200	200
at 100 °C	18,7	16	16

[1] Refer to the SKF traffic light concept.


SKF

Needle roller and cage assemblies

Needle roller and cage assemblies are ready-to-mount, self-contained bearing components. They are an excellent choice for applications that require a very rigid bearing arrangement as well as a high load carrying capacity. If the shaft and housing bore can serve as raceways, needle roller and cage assemblies require minimal radial space.

Standard needle roller and cage assemblies

SKF supplies needle roller and cage assemblies in single row (→ **fig. 1**) and double row (→ **fig. 2**) designs. They are characterized by:

- a simple and rugged design
- accurate guidance of the rollers in the cage pockets
- good running performance

Other needle roller and cage assemblies

Only part of SKF's comprehensive assortment of needle roller and cage assemblies is listed in the product tables. SKF also supplies other sizes and assemblies with cages that differ from the standard design, such as needle roller and cage assemblies with a split cage (→ **fig. 3**) that can be used where raceways are recessed in the shaft.

For connecting rods of internal combustion engines and compressors, SKF supplies special needle roller and cage assemblies for the gudgeon (wrist) pin (→ **fig. 4**) and crank pin (crankshaft journal) (→ **fig. 5**). The assemblies for these applications can provide excellent service in spite of high accelerations, high temperatures, unfavourable load conditions or poor lubrication conditions.

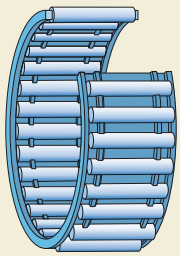
SKF also supplies special sizes of needle roller and cage assemblies to special order. Details of these other needle roller and cage assemblies are available on request.

Dimensions

The dimensions of needle roller and cage assemblies with an inside diameter up to and including 100 mm, where standardized, are in accordance with ISO 3030:1996.

Fig. 1

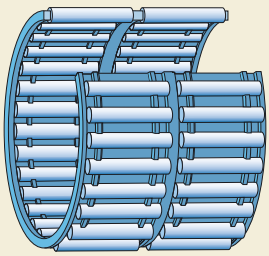
Needle roller and cage assembly, single row



K series

Fig. 2

Needle roller and cage assembly, double row



K .. ZW series

Fig. 3

Bearing arrangement incorporating split needle roller and cage assemblies

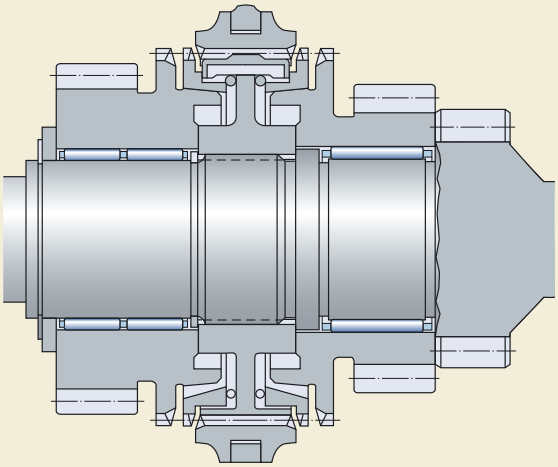


Fig. 4

Needle roller and cage assembly for gudgeon pin bearing arrangements

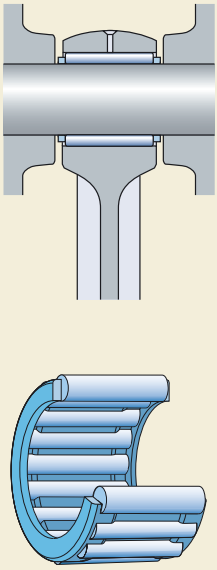
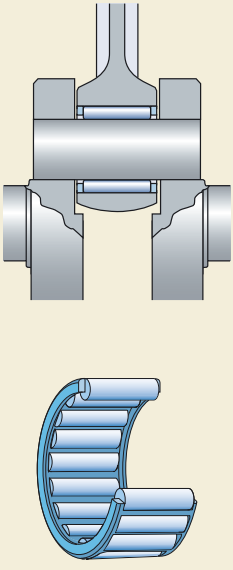


Fig. 5

Needle roller and cage assembly for crank pin bearing arrangements



Tolerances

SKF needle roller and cage assemblies contain rollers of one gauge of grade G2 (ISO 3096: 1996 Grade 2). The tolerance of each gauge is 2 µm. The deviation from the nominal dimensions of the needle rollers is printed on the package.

SKF needle roller and cage assemblies may comprise, as standard, assemblies of any standard gauge (→ **table 1**). If a specific gauge is required, it must be stated when ordering. Assemblies with rollers of a special gauge (→ **table 1**) are only available by special order on request.

The tolerances for the width U are –0,20/–0,80 mm for all needle roller and cage assemblies.

Paired mounting

Needle roller and cage assemblies that are mounted immediately adjacent to each other must incorporate rollers of the same gauge. This will enable both assemblies to share the load equally.

Operational clearance

The radial operational clearance of bearing arrangements incorporating needle roller and cage assemblies is determined by:

- the gauge of the needle rollers
- the shaft and housing raceway tolerances
- the operating temperature

Suitable raceway tolerance classes are listed in **table 2**. If these tolerances are applied when using assemblies with standard gauge rollers (→ **table 1**), under normal conditions the operational clearance will reach a value in the range of C2 to Normal radial internal clearance (→ **table 7**, **page 42**).

If a specific radial internal clearance is required, the various components of the arrangement should be matched following a mounting scheme similar to the one shown in **table 3**. The mean value of the needle roller gauge should be used to calculate the internal clearance, e.g. –6 µm for the gauge –5 to –7 µm.

Table 1

Needle roller gauges

Gauge type	Gauge in µm
Standard gauges	0/–2 –1/–3 –2/–4 –3/–5 –4/–6 –5/–7
Special gauges (to order)	–6/–8 –7/–9 –8/–10 –9/–11

Table 2

Raceway tolerance classes for needle roller and cage assemblies

Shaft Nominal diameter over	incl.	**Housing/shaft tolerance classes** for operational clearance lower side	medium	higher side
mm		–		
–	**80**	G6/j5 H6/h5	G6/h5 H6/g5	G6/g6 H6/f6
80	**120**	G6/h5	G6/g5	G6/f6
120	**–**	G6/h5 –	G6/g5 H6/f5	G6/f6 H6/e6

Misalignment

The ends of the needle rollers are relieved slightly to modify the line contact between the raceways and the rollers. This provides favourable load distribution in the needle roller and cage assembly and minimizes damaging edge stresses. It also enables single row needle roller and cage assemblies to accommodate a small amount of misalignment, approximately 1 min of arc between the shaft and housing.

The detrimental effects of misalignment increase with increasing bearing width and load. For additional information, contact the SKF application engineering service.

Table 3

Mounting scheme – example

Needle roller and cage assembly: K 16×22×12
Housing bore diameter: 22H6 (mm), deviation 0/+13 µm
Shaft diameter: 16h5 (mm), deviation 0/–8 µm

Shaft diameter Deviation group	**Housing bore diameter** Deviation groups 0 to +3		+3 to +6		+6 to +9		+9 to +13	
	Needle roller gauge limits	Radial internal clearance	Needle roller gauge limits	Radial internal clearance	Needle roller gauge limits	Radial internal clearance	Needle roller gauge limits	Radial internal clearance
µm	µm							
0 to –3					–5/–7	18–24	–3/–5	17–24
–3 to –6			–5/–7	18–24	–3/–5 –4/–6	17–25	–2/–4	18–25
–6 to –8	–5/–7 –6/–8	18–25	–3/–5 –4/–6	17–24	–2/–4 –3/–5	18–25	0/–2 –1/–3	17–25

Cages

SKF needle roller and cage assemblies are fitted, as standard, with a machined steel cage (→ **fig. 6**) or a sheet steel cage (→ **fig. 7**), with the exception of assemblies identified by the designation suffix TN. These have an injection moulded glass fibre reinforced polyamide 66 cage (→ **fig. 8**).

Note
Needle roller and cage assemblies with a polyamide 66 cage can be operated at temperatures up to 120 °C. The lubricants generally used for rolling bearings do not have a detrimental effect on cage properties. Exceptions are a few synthetic oils and greases with a synthetic oil base and lubricants containing a high proportion of EP additives when used at high temperatures.

For bearing arrangements that operate at continuously high temperatures or under arduous conditions, SKF recommends using assemblies with a steel cage.

For additional information about the temperature resistance and the applicability of cages, refer to the section *Cage materials*, starting on **page 44**.

Fig. 6

Machined steel cage

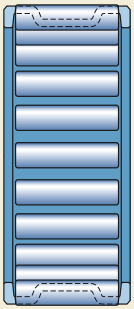


Fig. 7

Sheet steel cage

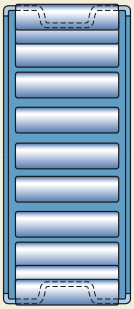
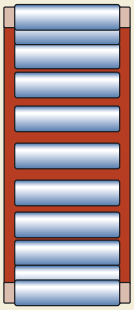


Fig. 8

Polyamide 66 cage



Abutment dimensions

Needle roller and cage assemblies should be axially guided. The lateral abutment surfaces should be fine turned and polished. For high speed operation they should be hardened and ground. Interruptions in the surface should be avoided. Snap rings can be used in less demanding applications, otherwise an intermediate ring, e.g. a spring steel washer, should be placed between the snap ring and the assembly. Appropriate values for the abutment diameters on the shaft and in the housing are listed in **table 4**.

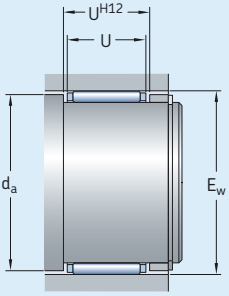
Supplementary designations

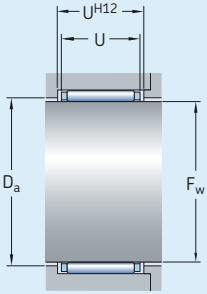
The designation suffixes used to identify certain features of SKF needle roller and cage assemblies are explained in the following.

DS Split needle roller and cage assembly
/SORT.. Tolerance grade of needle rollers of a needle roller and cage assembly, the figures following give the actual limits in µm, e.g. /SORT-2-4
TN Injection moulded cage of glass fibre reinforced polyamide 66
VG052 Single split cage of polyethersulfone (PES)
ZW Double row needle roller and cage assembly (double row cage)

Table 4

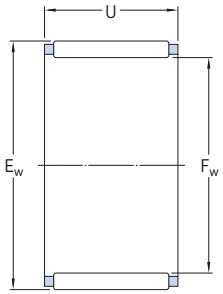
Abutment dimensions for needle roller and cage assemblies





Needle roller and cage assembly Inside diameter F_w over	incl.	Shaft abutment d_a	Housing abutment D_a
mm		mm	mm
–	25	E_w–0,3	F_w+0,4
25	65	E_w–0,5	F_w+0,5
65	–	E_w–1	F_w+1

Needle roller and cage assemblies
F_w **3 – 19** mm



K

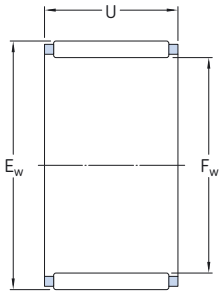
Dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation	Appropriate seal[1] Designation
F_w	E_w	U	C	C_0	P_u					
mm			kN		kN	r/min		g	–	–
3	5	7	1,51	1,34	0,134	40 000	45 000	0,3	**K 3×5×7 TN**	–
	5	9	1,72	1,63	0,17	38 000	43 000	0,4	**K 3×5×9 TN**	–
	6	7	1,42	1,02	0,104	38 000	43 000	0,4	**K 3×6×7 TN**	–
4	7	7	1,72	1,32	0,137	36 000	43 000	0,5	**K 4×7×7 TN**	–
	7	10	2,29	1,9	0,204	36 000	43 000	0,7	**K 4×7×10 TN**	–
5	8	8	2,29	2	0,212	36 000	40 000	0,7	**K 5×8×8 TN**	–
	8	10	2,92	2,7	0,29	36 000	40 000	0,9	**K 5×8×10 TN**	–
6	9	8	2,55	2,36	0,25	34 000	38 000	0,8	**K 6×9×8 TN**	–
	9	10	3,3	3,2	0,345	34 000	38 000	1,1	**K 6×9×10 TN**	–
	10	13	3,69	3,15	0,36	34 000	38 000	1,9	**K 6×10×13 TN**	G 6×10×2 S
7	9	7	1,68	1,83	0,19	34 000	38 000	0,6	**K 7×9×7 TN**	–
	10	8	2,81	2,75	0,29	32 000	36 000	0,9	**K 7×10×8 TN**	–
	10	10	3,58	3,75	0,415	32 000	36 000	1,0	**K 7×10×10 TN**	–
8	11	8	3,03	3,1	0,335	32 000	36 000	1,0	**K 8×11×8 TN**	–
	11	10	3,8	4,25	0,465	32 000	36 000	1,2	**K 8×11×10 TN**	–
	11	13	5,01	5,85	0,67	32 000	36 000	1,7	**K 8×11×13 TN**	–
	12	10	4,84	4,75	0,54	30 000	34 000	2,0	**K 8×12×10 TN**	G 8×12×3
9	12	10	4,4	5,2	0,57	30 000	34 000	1,5	**K 9×12×10 TN**	–
	12	13	5,72	7,2	0,815	30 000	34 000	2,1	**K 9×12×13 TN**	–
10	13	10	4,57	5,7	0,63	28 000	32 000	1,6	**K 10×13×10 TN**	–
	13	13	5,94	8	0,9	28 000	32 000	2,3	**K 10×13×13 TN**	–
	13	16	6,82	9,5	1,08	28 000	32 000	2,9	**K 10×13×16 TN**	–
	14	10	5,61	6,1	0,695	28 000	32 000	2,5	**K 10×14×10 TN**	G 10×14×3
	14	13	5,83	6,3	0,72	28 000	32 000	4,6	**K 10×14×13 TN**	G 10×14×3
	16	12	7,65	7,2	0,85	28 000	32 000	5,5	**K 10×16×12 TN**	–
12	15	10	4,73	6,2	0,695	26 000	30 000	1,9	**K 12×15×10 TN**	–
	15	13	6,16	8,65	0,98	26 000	30 000	2,3	**K 12×15×13 TN**	–
	16	13	7,65	9,5	1,1	26 000	30 000	3,6	**K 12×16×13 TN**	G 12×16×3
	17	13	9,13	10,4	1,22	26 000	30 000	4,9	**K 12×17×13 TN**	–
	18	12	9,52	10	1,18	26 000	30 000	6,0	**K 12×18×12 TN**	G/SD 12×18×3

[1] For additional information, refer to the section *Radial shaft seals with a low cross sectional height*, starting on **page 208**.

Dimensions			Basic load ratings		Fatigue load limit	Speed ratings		Mass	Designation	Appropriate seal[1]
			dynamic	static		Reference speed	Limiting speed			Designation
F_w	E_w	U	C	C_0	P_u					
mm			kN		kN	r/min		g	–	–
14	18	10	6,93	8,65	1	24 000	28 000	4,0	**K 14×18×10**	–
	18	13	7,92	10,2	1,18	24 000	28 000	6,5	**K 14×18×13**	–
	18	15	9,13	12,5	1,46	24 000	28 000	5,0	**K 14×18×15 TN**	–
	18	17	10,5	14,6	1,7	24 000	28 000	8,0	**K 14×18×17**	–
	20	12	9,9	10,6	1,25	24 000	28 000	8,5	**K 14×20×12**	G/SD 14×20×3
15	18	17	7,65	12,2	1,4	24 000	28 000	4,6	**K 15×18×17 TN**	–
	19	10	7,21	9,3	1,06	24 000	28 000	5,0	**K 15×19×10**	–
	19	13	8,25	11,2	1,29	24 000	28 000	7,0	**K 15×19×13**	–
	19	17	10,8	15,6	1,86	24 000	28 000	9,5	**K 15×19×17**	–
	20	13	9,52	11,6	1,34	24 000	26 000	7,0	**K 15×20×13**	–
	21	15	13,8	16,3	2	24 000	26 000	11	**K 15×21×15**	G/SD 15×21×3
	21	21	18,7	24,5	3	24 000	26 000	17	**K 15×21×21**	G/SD 15×21×3
16	20	10	7,48	10	1,16	24 000	26 000	5,5	**K 16×20×10**	–
	20	13	8,58	12	1,37	24 000	26 000	7,5	**K 16×20×13**	–
	20	17	11,2	17	2	24 000	26 000	10	**K 16×20×17**	–
	22	12	11	12,5	1,5	22 000	26 000	10	**K 16×22×12**	G/SD 16×22×3
	22	16	14,2	17,6	2,12	22 000	26 000	12	**K 16×22×16**	G/SD 16×22×3
	22	20	17,6	22,8	2,8	22 000	26 000	17	**K 16×22×20**	G/SD 16×22×3
	24	20	20,5	23,6	2,9	22 000	24 000	22	**K 16×24×20**	G/SD 16×24×3
17	21	10	7,81	10,8	1,22	22 000	26 000	5,5	**K 17×21×10**	–
	21	13	10,1	14,6	1,73	22 000	26 000	6,5	**K 17×21×13**	–
	21	17	11,7	18,3	2,12	22 000	26 000	9,5	**K 17×21×17**	–
18	22	10	8,09	11,4	1,32	22 000	24 000	6,0	**K 18×22×10**	–
	22	13	8,8	12,9	1,5	22 000	24 000	8,0	**K 18×22×13**	–
	22	17	11,7	18,3	2,16	22 000	24 000	11	**K 18×22×17**	–
	24	12	12,1	15	1,8	20 000	24 000	12	**K 18×24×12**	G/SD 18×24×3
	24	13	12,5	15,3	1,86	20 000	24 000	13	**K 18×24×13**	G/SD 18×24×3
	24	20	19,4	27	3,25	20 000	24 000	18	**K 18×24×20**	G/SD 18×24×3
	25	22	22	29	3,55	20 000	24 000	23	**K 18×25×22**	–
19	23	13	9,13	13,7	1,6	20 000	24 000	8,0	**K 19×23×13**	–
	23	17	12,1	19,3	2,28	20 000	24 000	11	**K 19×23×17**	–

[1] For additional information, refer to the section *Radial shaft seals with a low cross sectional height*, starting on **page 208**.

Needle roller and cage assemblies
F_w **20 – 30** mm



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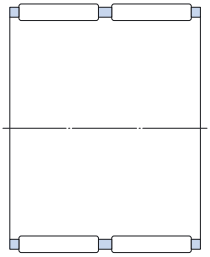


K..ZW

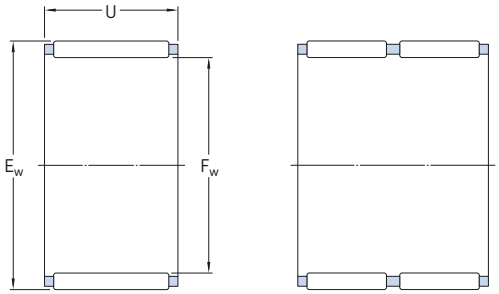
Dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation	Appropriate seal[1] Designation
F_w	E_w	U	C	C_0	P_u					
mm			kN		kN	r/min		g	–	–
20	24	10	8,58	12,9	1,46	20 000	22 000	6,5	**K 20×24×10**	–
	24	13	9,52	14,6	1,66	20 000	22 000	9,0	**K 20×24×13**	–
	24	17	12,5	20,8	2,4	20 000	22 000	12	**K 20×24×17**	–
	26	12	12,8	16,3	1,96	19 000	22 000	11	**K 20×26×12**	G/SD 20×26×4
	26	13	13,8	18	2,16	19 000	22 000	12	**K 20×26×13**	G/SD 20×26×4
	26	17	18,3	26	3,2	19 000	22 000	16	**K 20×26×17**	G/SD 20×26×4
	26	20	20,1	29	3,6	19 000	22 000	19	**K 20×26×20**	G/SD 20×26×4
	28	16	19	22,4	2,7	18 000	20 000	20	**K 20×28×16**	G/SD 20×28×4
	28	20	22,9	28,5	3,45	18 000	20 000	27	**K 20×28×20**	G/SD 20×28×4
	28	25	29,2	39	4,9	18 000	20 000	32	**K 20×28×25**	G/SD 20×28×4
	30	30	34,1	41,5	5,2	17 000	20 000	49	**K 20×30×30**	–
21	25	13	9,68	15,3	1,76	19 000	22 000	9,0	**K 21×25×13**	–
22	26	10	8,8	13,7	1,56	18 000	20 000	7,5	**K 22×26×10**	–
	26	13	10,1	16,3	1,86	18 000	20 000	9,5	**K 22×26×13**	–
	26	17	13,2	22,8	2,7	18 000	20 000	12	**K 22×26×17**	–
	28	17	18,3	27	3,25	17 000	20 000	18	**K 22×28×17**	G/SD 22×28×4
	29	16	19,4	25,5	3,05	17 000	19 000	16	**K 22×29×16**	
	30	15	19	23,6	2,8	17 000	19 000	18	**K 22×30×15 TN**	G/SD 22×30×4
	32	24	31,9	40	4,9	16 000	18 000	43	**K 22×32×24**	–
23	35	16	24,2	23,2	2,9	15 000	17 000	29	**K 23×35×16 TN**	–
24	28	10	9,35	15	1,73	17 000	19 000	8,5	**K 24×28×10**	–
	28	13	10,6	18	2,08	17 000	19 000	10	**K 24×28×13**	–
	28	17	14	25,5	3	17 000	19 000	13	**K 24×28×17**	–
	30	17	18,7	27,5	3,4	16 000	18 000	19	**K 24×30×17**	–
	30	31	26,4	43	5,3	16 000	18 000	32	**K 24×30×31 ZW**	–

[1] For additional information, refer to the section *Radial shaft seals with a low cross sectional height*, starting on **page 208**.

Dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation	Appropriate seal[1] Designation
F_w	E_w	U	C	C_0	P_u					
mm			kN		kN	r/min		g	–	–
25	29	10	9,52	15,6	1,8	16 000	18 000	8,5	**K 25×29×10**	–
	29	13	10,8	18,6	2,16	16 000	18 000	11	**K 25×29×13**	–
	29	17	14,2	26,5	3,1	16 000	18 000	14	**K 25×29×17**	–
	30	17	17,9	30,5	3,6	16 000	18 000	16	**K 25×30×17**	–
	30	20	20,9	36,5	4,4	16 000	18 000	18	**K 25×30×20**	–
	30	26	20,5	36	4,15	16 000	18 000	19	**K 25×30×26 ZW**	–
	31	17	18,7	28,5	3,45	16 000	18 000	19	**K 25×31×17**	–
	31	21	23,3	38	4,75	16 000	18 000	20	**K 25×31×21**	–
	32	16	19,8	27,5	3,35	15 000	17 000	21	**K 25×32×16**	G 25×32×4
	33	20	27,5	38	4,65	15 000	17 000	33	**K 25×33×20**	G/SD 25×33×4
	33	24	31,9	47,5	5,85	15 000	17 000	39	**K 25×33×24**	G/SD 25×33×4
	35	30	44,6	62	7,8	15 000	17 000	65	**K 25×35×30**	G/SD 25×35×4
26	30	13	11,2	19,6	2,28	16 000	18 000	11	**K 26×30×13**	–
	30	17	14,7	27,5	3,25	16 000	18 000	15	**K 26×30×17**	–
	30	22	15,1	29	3,35	16 000	18 000	12	**K 26×30×22 ZW**	–
28	33	13	14,7	24,5	2,85	14 000	16 000	13	**K 28×33×13**	–
	33	17	19	33,5	4,05	14 000	16 000	17	**K 28×33×17**	–
	34	17	20,9	33,5	4,15	14 000	16 000	24	**K 28×34×17**	–
	35	16	20,5	30	3,55	14 000	16 000	24	**K 28×35×16**	G/SD 28×35×4
	35	18	22,9	34,5	4,15	14 000	16 000	27	**K 28×35×18**	G/SD 28×35×4
	40	25	42,9	55	6,95	13 000	15 000	70	**K 28×40×25**	–
30	34	13	11,9	22	2,55	14 000	15 000	14	**K 30×34×13**	–
	35	13	15,1	25,5	3	13 000	15 000	14	**K 30×35×13**	–
	35	17	18,7	34	4,05	13 000	15 000	19	**K 30×35×17**	–
	35	27	29,2	60	7,35	13 000	15 000	30	**K 30×35×27**	–
	37	16	22	33,5	4	13 000	15 000	27	**K 30×37×16**	G/SD 30×37×4
	37	18	25,1	39	4,65	13 000	15 000	30	**K 30×37×18**	G/SD 30×37×4
	40	18	30,3	40	4,9	12 000	14 000	48	**K 30×40×18**	G/SD 30×40×4
	40	30	46,8	69,5	8,65	12 000	14 000	73	**K 30×40×30**	G/SD 30×40×4

[1] For additional information, refer to the section *Radial shaft seals with a low cross sectional height*, starting on **page 208**.

Needle roller and cage assemblies
F_w **32 – 55** mm



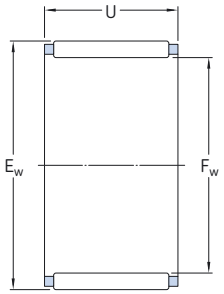
K K..ZW

Dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation	Appropriate seal[1] Designation
F_w	E_w	U	C	C_0	P_u					
mm			kN		kN	r/min		g	–	–
32	37	13	14,7	25,5	3	13 000	14 000	18	**K 32×37×13**	–
	37	17	19	35,5	4,25	13 000	14 000	19	**K 32×37×17**	–
	37	27	28,6	60	7,35	13 000	14 000	30	**K 32×37×27**	–
	38	20	25,1	45	5,6	12 000	14 000	30	**K 32×38×20**	–
	39	16	22,9	35,5	4,25	12 000	14 000	37	**K 32×39×16**	–
	39	18	25,5	41,5	5	12 000	14 000	31	**K 32×39×18**	–
	40	25	35,8	58,5	7,2	12 000	14 000	49	**K 32×40×25**	–
	40	42	48,4	83	10,2	14 000	12 000	77	**K 32×40×42 ZWTN**	–
	46	32	62,7	83	10,4	11 000	13 000	119	**K 32×46×32**	–
35	40	13	15,4	28	3,25	12 000	13 000	19	**K 35×40×13**	–
	40	17	19,8	39	4,65	12 000	13 000	21	**K 35×40×17**	–
	40	25	28,1	60	7,35	12 000	13 000	31	**K 35×40×25**	–
	40	27	23,8	49	6	12 000	13 000	39	**K 35×40×27 TN**	–
	42	16	23,3	37,5	4,5	11 000	13 000	34	**K 35×42×16**	G/SD 35×42×4
	42	18	26,4	44	5,3	11 000	13 000	34	**K 35×42×18**	G/SD 35×42×4
	42	20	29,2	50	6	11 000	13 000	37	**K 35×42×20**	G/SD 35×42×4
	42	30	37,4	68	8,5	11 000	13 000	67	**K 35×42×30**	G/SD 35×42×4
	45	20	35,2	50	6,2	11 000	12 000	56	**K 35×45×20**	G/SD 35×45×4
	45	30	50,1	80	10	11 000	12 000	80	**K 35×45×30**	G/SD 35×45×4
37	42	17	21,6	43	5,2	11 000	13 000	22	**K 37×42×17**	–
38	43	17	19,8	39	4,65	11 000	12 000	29	**K 38×43×17**	–
	43	27	30,3	68	8,3	11 000	12 000	43	**K 38×43×27**	–
	46	20	34,1	57	6,95	10 000	12 000	47	**K 38×46×20**	–
	46	32	52,3	100	12,5	10 000	12 000	76	**K 38×46×32**	–
39	44	26	26	57	6,7	10 000	12 000	45	**K 39×44×26 ZW**	–
40	45	13	16,8	32,5	3,8	10 000	12 000	22	**K 40×45×13**	–
	45	17	20,5	41,5	5	10 000	12 000	31	**K 40×45×17**	–
	45	27	31,4	73,5	9	10 000	12 000	46	**K 40×45×27**	–
	47	18	28,6	50	6,1	10 000	11 000	39	**K 40×47×18**	G/SD 40×47×4
	47	20	31,4	57	6,95	10 000	11 000	42	**K 40×47×20**	G/SD 40×47×4
	48	20	34,7	58,5	7,35	10 000	11 000	49	**K 40×48×20**	–

[1] For additional information, refer to the section *Radial shaft seals with a low cross sectional height*, starting on **page 208**.

Dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation	Appropriate seal[1] Designation
F_w	E_w	U	C	C_0	P_u					
mm			kN		kN	r/min		g	–	–
42	47	13	17,2	33,5	4	10 000	11 000	18	**K 42×47×13**	–
	47	17	20,9	43	5,2	10 000	11 000	32	**K 42×47×17**	–
	47	30	31,9	76,5	9	10 000	11 000	54	**K 42×47×30 ZW**	–
	50	20	31,9	54	7,2	9 500	11 000	53	**K 42×50×20**	–
43	48	17	20,9	43	5,2	9 500	11 000	30	**K 43×48×17**	–
	48	27	31,9	76,5	9,3	9 500	11 000	50	**K 43×48×27**	–
45	50	17	21,6	46,5	5,6	9 000	10 000	34	**K 45×50×17**	–
	50	27	33	81,5	10	9 000	10 000	51	**K 45×50×27**	–
	52	18	30,3	57	6,95	9 000	10 000	42	**K 45×52×18**	G/SD 45×52×4
	53	20	37,4	68	8,3	9 000	10 000	55	**K 45×53×20**	–
	53	21	36,9	67	8,3	9 000	10 000	60	**K 45×53×21**	–
	53	28	49,5	98	12,2	9 000	10 000	81	**K 45×53×28**	–
	59	18	44	53	6,55	8 500	9 500	72	**K 45×59×18 TN**	–
	59	32	69,3	102	12,9	8 500	9 500	148	**K 45×59×32**	–
47	52	17	22,4	49	6	9 000	10 000	35	**K 47×52×17**	–
	52	27	33,6	83	10,2	9 000	10 000	51	**K 47×52×27**	–
50	55	13,5	17,6	36,5	4,3	8 500	9 500	30	**K 50×55×13.5**	–
	55	17	21,2	47,5	5,7	8 500	9 500	35	**K 50×55×17**	–
	55	20	25,5	60	7,2	8 500	9 500	43	**K 50×55×20**	–
	55	30	37,4	98	12	8 500	9 500	65	**K 50×55×30**	–
	57	18	31,9	64	7,8	8 000	9 000	47	**K 50×57×18**	–
	58	20	34,1	62	7,65	8 000	9 000	75	**K 50×58×20**	G/SD 50×58×4
	58	25	41,8	81,5	10,2	8 000	9 000	90	**K 50×58×25**	G/SD 50×58×4
52	57	12	17,2	36,5	4,3	8 000	9 000	24	**K 52×57×12**	–
55	60	20	27	67	8,15	7 500	8 500	40	**K 55×60×20**	–
	60	27	35,8	96,5	12	7 500	8 500	60	**K 55×60×27**	–
	60	30	39,6	108	13,4	7 500	8 500	71	**K 55×60×30**	–
	62	18	34,1	71	8,5	7 500	8 500	52	**K 55×62×18**	–
	63	20	38	75	9,15	7 500	8 500	67	**K 55×63×20**	G 55×63×5
	63	25	48,4	102	12,7	7 500	8 500	80	**K 55×63×25**	G 55×63×5
	63	32	59,4	129	16,3	7 500	8 500	100	**K 55×63×32**	G 55×63×5

[1] For additional information, refer to the section *Radial shaft seals with a low cross sectional height*, starting on **page 208**.



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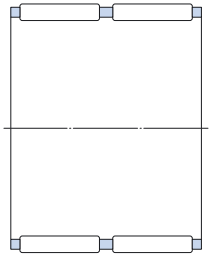


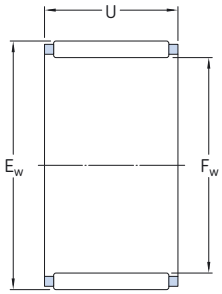
K..ZW

Dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation	Appropriate seal[1] Designation
F_w	E_w	U	C	C_0	P_u					
mm			kN		kN	r/min		g	–	–
58	65	18	33,6	71	8,65	7 000	8 000	52	**K 58×65×18**	–
	65	36	47,3	108	12,9	7 000	8 000	130	**K 58×65×36 ZW**	–
60	65	20	28,1	72	8,8	7 000	8 000	52	**K 60×65×20**	–
	65	30	41,3	116	14,3	7 000	8 000	77	**K 60×65×30**	–
	66	33	44	112	13,7	7 000	8 000	100	**K 60×66×33 ZW**	–
	66	40	55	150	18,6	7 000	8 000	120	**K 60×66×40 ZW**	–
	68	20	41,8	86,5	10,6	6 700	7 500	71	**K 60×68×20**	–
	68	23	47,3	102	12,5	6 700	7 500	94	**K 60×68×23**	–
	68	25	51,2	112	14	6 700	7 500	89	**K 60×68×25**	–
	68	30	42,9	88	10,6	6 700	7 500	130	**K 60×68×30 ZW**	–
	75	42	112	196	25	6 300	7 500	240	**K 60×75×42**	–
62	70	40	62,7	146	18,6	6 700	7 500	170	**K 62×70×40 ZW**	–
64	70	16	26,4	60	7,35	6 300	7 500	53	**K 64×70×16**	–
65	70	20	29,2	76,5	9,3	6 300	7 500	56	**K 65×70×20**	–
	70	30	41,8	125	15,3	6 300	7 500	83	**K 65×70×30**	–
	73	23	41,8	90	11,8	6 300	7 000	110	**K 65×73×23**	–
	73	30	53,9	125	15,6	6 300	7 000	140	**K 65×73×30**	–
68	74	20	33,6	83	10,4	6 000	7 000	71	**K 68×74×20**	–
	74	30	44,6	118	15	6 000	7 000	100	**K 68×74×30**	–
	74	35	46,8	125	15,3	7 000	6 000	120	**K 68×74×35 ZW**	–
70	76	20	34,1	86,5	10,6	6 000	6 700	71	**K 70×76×20**	–
	76	30	50,1	140	17,6	6 000	6 700	110	**K 70×76×30**	–
	78	30	57,2	137	17	6 000	6 700	150	**K 70×78×30**	G 70×78×5
72	80	20	39,6	85	10,6	5 600	6 300	98	**K 72×80×20**	–
73	79	20	35,2	90	11,2	5 600	6 300	75	**K 73×79×20**	–
75	81	20	35,8	93	11,6	5 600	6 300	79	**K 75×81×20**	–
	81	30	50,1	143	18	5 600	6 300	110	**K 75×81×30**	–
	83	23	47,3	110	13,7	5 300	6 300	120	**K 75×83×23**	–
	83	30	59,4	143	18	5 300	6 300	150	**K 75×83×30**	–
	83	35	60,5	146	18	6 300	5 300	182	**K 75×83×35 ZW**	–
	83	40	69,3	176	22	6 300	5 300	211	**K 75×83×40 ZW**	–

[1] For additional information, refer to the section *Radial shaft seals with a low cross sectional height*, starting on **page 208**.

Dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation
F_w	E_w	U	C	C_0	P_u				
mm			kN		kN	r/min		g	–
80	86	20	36,9	98	12,2	5 300	6 000	60	**K 80×86×20**
	88	30	68,2	176	22	5 000	6 000	140	**K 80×88×30**
	88	40	72,1	193	23,6	6 000	5 000	227	**K 80×88×40 ZW**
	88	46	84,2	232	28,5	6 000	5 000	260	**K 80×88×46 ZW**
85	92	20	42,9	108	13,2	4 800	5 600	100	**K 85×92×20**
90	97	20	42,9	114	13,7	4 500	5 300	110	**K 90×97×20**
	98	27	58,3	150	18,6	4 500	5 300	150	**K 90×98×27**
	98	30	64,4	173	21,6	4 500	5 300	170	**K 90×98×30**
95	103	30	66	180	22,8	4 300	5 000	170	**K 95×103×30**
	103	40	79,2	228	28,5	5 000	4 300	266	**K 95×103×40 ZW**
100	107	21	45,7	127	15,3	4 000	4 800	120	**K 100×107×21**
	108	27	55	143	17,6	4 000	4 800	190	**K 100×108×27**
	108	30	67,1	190	23,6	4 000	4 800	180	**K 100×108×30**
105	112	21	45,7	129	15,3	4 000	4 500	130	**K 105×112×21**
110	117	24	53,9	160	18,6	3 800	4 300	170	**K 110×117×24**
	118	30	73,7	220	26,5	3 800	4 300	220	**K 110×118×30**
115	123	27	60,5	170	20	3 600	4 000	200	**K 115×123×27**
120	127	24	56,1	176	20,4	3 400	4 000	170	**K 120×127×24**
125	133	35	82,5	260	30,5	3 200	3 800	280	**K 125×133×35**
130	137	24	58,3	186	21,2	3 200	3 600	170	**K 130×137×24**
135	143	35	88	290	33,5	3 000	3 400	300	**K 135×143×35**
145	153	26	70,4	224	25	2 800	3 200	260	**K 145×153×26**
150	160	46	140	475	53	2 800	3 000	570	**K 150×160×46**
155	163	26	72,1	236	25,5	2 600	3 000	270	**K 155×163×26**

Needle roller and cage assemblies
F_w **160 – 265** mm



K

Dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation
F_w	E_w	U	C	C_0	P_u				
mm			kN		kN	r/min		g	–
160	170	46	145	510	56	2 600	2 800	550	**K 160×170×46**
165	173	26	76,5	265	28,5	2 400	2 800	320	**K 165×173×26**
175	183	32	95,2	355	37,5	2 400	2 600	400	**K 175×183×32**
185	195	37	123	425	45	2 200	2 400	610	**K 185×195×37**
195	205	37	125	450	46,5	2 000	2 400	620	**K 195×205×37**
210	220	42	147	560	57	1 900	2 200	740	**K 210×220×42**
220	230	42	151	585	58,5	1 800	2 000	790	**K 220×230×42**
240	250	42	157	630	62	1 700	1 900	850	**K 240×250×42**
265	280	50	242	850	83	1 500	1 700	1 800	**K 265×280×50**


SKF

Drawn cup needle roller bearings

Drawn cup needle roller bearings, as the name suggests, are needle roller bearings with a deep drawn, thin-walled outer ring with either open ends or a closed end. They are characterized by a very low sectional height and high load carrying capacity. Drawn cup needle roller bearings are typically used in applications where the housing bore cannot be used as a raceway for a needle roller and cage assembly, but where a very compact and economical bearing arrangement is required.

Generally, drawn cup needle roller bearings have a recommended maximum operating temperature of 140 °C, unless otherwise stated in the relevant sections in this chapter. The maximum operating temperature is limited by the seal and cage materials and the applied grease.

SKF supplies a wide assortment of drawn cup needle roller bearings. This includes:

- drawn cup needle roller bearings with open ends (→ **fig. 1**)
- drawn cup needle roller bearings with a closed end (→ **fig. 2**)
- full complement drawn cup needle roller bearings with open ends (→ **fig. 3**)

Drawn cup needle roller bearings with a closed end are suitable for bearing arrangements at the ends of shafts. The profiled design of the closed end accommodates small axial guidance forces. Drawn cup needle roller bearings generally run directly on the shaft. However, in cases where the shaft cannot be hardened and ground, they can be combined with an inner ring (→ **fig. 4**).

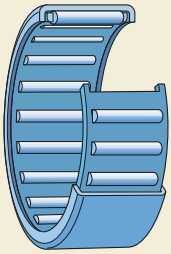
The drawn cup of hardened steel and the needle roller and cage assembly of these bearings form a non-separable unit. The space available for lubricant is large enough to enable long relubrication intervals.

Typically, drawn cup needle roller bearings have a single row of rollers. However, wide sizes incorporate two needle roller and cage assemblies immediately adjacent to each other with a lubrication hole in the outer ring (→ **fig. 5**).

On request, any single row drawn cup needle roller bearing for shaft diameters of 7 mm and above can be supplied with a lubrication hole in the outer ring (→ **fig. 6**).

Fig. 1

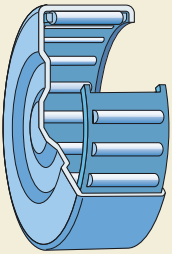
Drawn cup needle roller bearing with open ends



HK series

Fig. 2

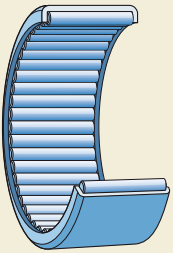
Drawn cup needle roller bearing with a closed end



BK series

Fig. 3

Full complement drawn cup needle roller bearing with open ends



HN series

Fig. 4

Drawn cup needle roller bearing combined with an inner ring and an external seal

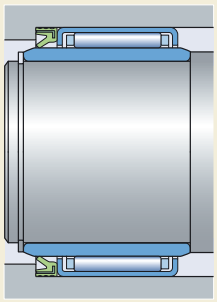


Fig. 5

Wide size drawn cup needle roller bearing, double row, with a lubrication hole

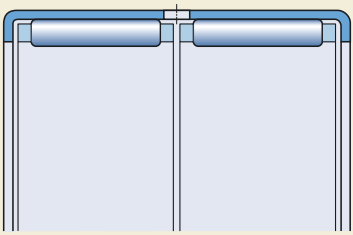


Fig. 6

Drawn cup needle roller bearing with a closed end and lubrication hole

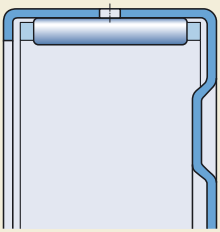
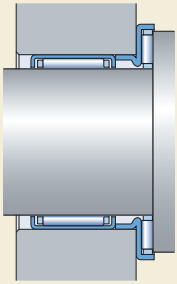


Fig. 7

Drawn cup needle roller bearing combined with a needle roller thrust bearing, AXW series



Drawn cup needle roller bearings are mounted with an interference fit in the housing bore. Therefore, shoulders or snap rings are not required to locate the bearing axially so the design of the housing bore is simple and can be produced economically.

To accommodate combined radial and axial loads (→ **fig. 7**), drawn cup needle roller bearings of certain sizes can be combined with a needle roller thrust bearing with a centring spigot, AXW series.

Sealed drawn cup needle roller bearings

For applications where a sufficiently efficient seal is not available, or cannot be used for space reasons, drawn cup needle roller bearings can also be supplied with integral lip seals. These include:

- drawn cup needle roller bearings with open ends, sealed on one side, designation suffix RS (→ **fig. 8**), available for shaft diameters ranging from 8 mm to 50 mm
- drawn cup needle roller bearings with open ends, sealed on both sides, designation suffix .2RS (→ **fig. 9**), available for shaft diameters ranging from 8 mm to 50 mm
- sealed drawn cup needle roller bearings with a closed end, designation suffix RS (→ **fig. 10**), available for shaft diameters ranging from 10 mm to 25 mm

The integral seals are contact seals made of polyurethane (AU), fluoro rubber (FKM) or acrylonitrile-butadiene rubber (NBR). The use of a sealed drawn cup needle roller bearing is, under normal conditions, an extremely cost-effective solution to exclude solid contaminants and moisture and retain the lubricant in the bearing. The permissible operating temperature range for sealed bearings is –30 to +100 °C.

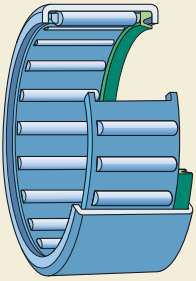
Initial grease fill and relubrication

Sealed drawn cup needle roller bearings are filled at the factory with a high-quality grease that has good corrosion inhibiting properties. The relatively large quantity of grease in the bearings means they can be operated for long periods before relubrication is required. SKF recommends using SKF LGWA 2 grease for relubrication.

For additional information about greases, refer to the section *Lubrication*, starting on **page 52** and **table 1** on **page 54**.

Fig. 8

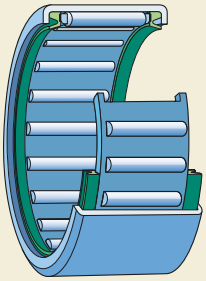
Drawn cup needle roller bearing with open ends, sealed on one side



HK .. RS series

Fig. 9

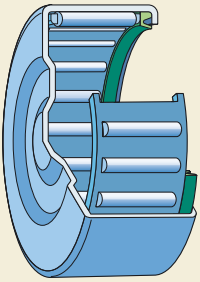
Drawn cup needle roller bearing with open ends, sealed on both sides



HK ...2RS series

Fig. 10

Sealed drawn cup needle roller bearing with a closed end



BK .. RS series

Full complement drawn cup needle roller bearings

Full complement drawn cup needle roller bearings with open ends (→ **fig. 3**, **page 76**) are suitable for very heavy radial loads at moderate speeds.

Initial grease fill and relubrication

A special grease is used to secure the rollers during transportation, however, this grease does not provide sufficient long term lubrication. Therefore, relubrication after mounting may be necessary. Depending on the required consistency class, SKF recommends SKF LGEP 2 or SKF LGMW 1 grease for relubrication. For additional information and characteristics (→ **table 2**, **page 54**) of the initial grease fill and the greases for relubrication, refer to the section *Lubrication*, starting on **page 52** or contact the SKF application engineering service.

Dimensions

The boundary dimensions of drawn cup needle roller bearings are in accordance with ISO 3245:2007, as far as they have been standardized.

Tolerances

The dimensional accuracy of drawn cup needle roller bearings cannot be checked until they have been mounted, because the thin-walled outer ring may be slightly out-of-round. Only after the bearing has been pressed into a housing bore that is machined to the recommended tolerance classes can the outer ring obtain its correct form, which is crucial for bearing performance. To check the inside diameter F_w of the roller set, the bearing must first be pressed into a thick-walled gauge ring with a bore diameter as listed in **table 1**. A measuring mandrel can then be used to check the inside diameter deviation. The permissible deviations are also listed in the table.

The tolerance values listed are in accordance with ISO 3245:2007, as far as they have been standardized.

Table 1

Tolerances for drawn cup needle roller bearings

Bearing Inside diameter F_w	Outside diameter D	**Gauge ring** Bore diameter (measured)	**Deviations from nominal inside diameter** high	low
mm		mm	µm	
3	6,5	6,484	+24	+6
4	8	7,984	+28	+10
5	9	8,984	+28	+10
6	10	9,984	+28	+10
7	11	10,980	+31	+13
8	12	11,980	+31	+13
9	13	12,980	+31	+13
10	14	13,980	+31	+13
12	16	15,980	+34	+16
12	18	17,980	+34	+16
13	19	18,976	+34	+16
14	20	19,976	+34	+16
15	21	20,976	+34	+16
16	22	21,976	+34	+16
17	23	22,976	+34	+16
18	24	23,976	+34	+16
20	26	25,976	+41	+20
22	28	27,976	+41	+20
25	32	31,972	+41	+20
28	35	34,972	+41	+20
30	37	36,972	+41	+20
32	39	38,972	+50	+25
35	42	41,972	+50	+25
40	47	46,972	+50	+25
45	52	51,967	+50	+25
50	58	57,967	+50	+25
55	63	62,967	+60	+30
60	68	67,967	+60	+30

The width tolerance is 0/–0,3 mm for all drawn cup needle roller bearing sizes.

Paired mounting

If drawn cup needle roller bearings are to be mounted immediately adjacent to each other, the deviations from the nominal internal diameter must be the same for both bearings if they are to share the load equally.

Misalignment

The ends of the needle rollers are relieved slightly to modify the line contact between the raceways and the rollers. This provides favourable load distribution in the bearing and minimizes damaging edge stresses. It also enables single row drawn cup needle roller bearings to accommodate a small amount of misalignment, approximately 1 min of arc between the shaft and housing.

The detrimental effects of misalignment increase with increasing bearing width and load. For additional information, contact the SKF application engineering service.

Cages

SKF drawn cup needle roller bearings are fitted, as standard, with a sheet steel cage (→ **fig. 11**), except for those identified by the designation suffix TN. These have an injection moulded, glass fibre reinforced polyamide 66 cage (→ **fig. 12**).

Note
Drawn cup needle roller bearings with a polyamide 66 cage can be operated at temperatures up to +120 °C. The lubricants generally used for rolling bearings do not have a detrimental effect on cage properties. Exceptions are a few synthetic oils and greases with a synthetic oil base and lubricants containing a high proportion of EP additives when used at high temperatures.

For bearing arrangements that will operate at continuously high temperatures or under arduous conditions, SKF recommends using bearings with a steel cage.

For detailed information about the temperature resistance and the applicability of cages, refer to the section *Cage materials*, starting on **page 44**.

Shaft and housing tolerances

Drawn cup needle roller bearings need a housing bore that has a good dimensional form and accuracy. For these bearings, to obtain the necessary interference fit in the housing, the tolerance classes listed in **table 2** must be applied. The cylindricity of the housing bore should be within IT5/2 tolerance grade and the shaft raceway should be within IT3 tolerance grade.

Fig. 11

Sheet steel cage

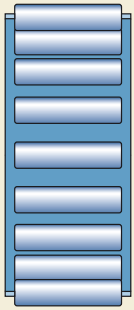
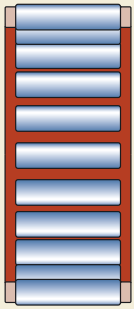


Fig. 12

Polyamide 66 cage



Operational clearance

When the recommended tolerance classes are applied, the inside diameter F_w (diameter under the rollers) will be approximately within F8 tolerance class. This, together with the recommended shaft tolerance class, which is also listed in **table 2**, will reach a suitable (medium) operational clearance in the range of C2 to C3 radial internal clearance. The clearance value depends on the shaft diameter, the operating

temperature, and on the raceway diameter when combined with an inner ring.

Mounting instructions

Drawn cup needle roller bearings should be mounted with a heavy interference fit in the housing bore. Therefore, SKF recommends mounting them using a mounting dolly (→ **fig. 13**). An O-ring provides a simple means of retaining the bearing on the mounting dolly. The stamped side face of drawn cup needle roller bearings should preferably abut the flange of the mounting dolly.

If grease lubrication is going to be used, the bearing should be lubricated before mounting.

Note
Special care should be taken to prevent the bearings from skewing or tilting when they are being pressed into the housing. Otherwise the rollers and raceways could easily be damaged.

Static safety factor

SKF recommends applying a static safety factor of 3 or larger, i.e. $s_0 = C_0/P_0 \geq 3$.

Supplementary designations

The designation suffixes used to identify certain features of SKF drawn cup needle roller bearings are explained in the following.

AS1 One lubrication hole in the outer ring
H.. Needle roller bearing without an inner ring, with reduced inside diameter (under rollers) tolerance, followed by tolerance limits in µm, e.g. H+27+20
RS Contact seal on one side of the bearing
.2RS Contact seal on both sides of a drawn cup needle roller bearing with open ends
TN Injection moulded cage of glass fibre reinforced polyamide 66

Table 2

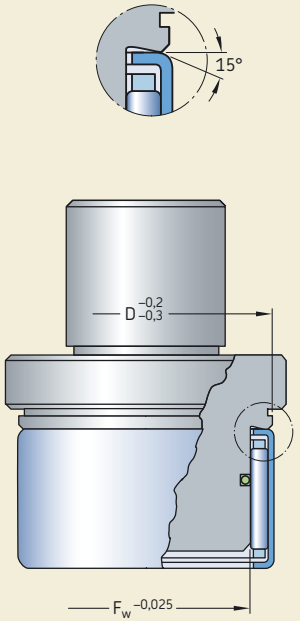
Shaft and housing tolerance classes

Housing material[1]	Tolerance classes		
	Housing bore seat[2]	Raceway on the shaft	Shaft inner ring seat
Steel, cast iron	N6 N7	h5 h6	k5 j6
Light alloy	R6 R7	h5 h6	k5 j6

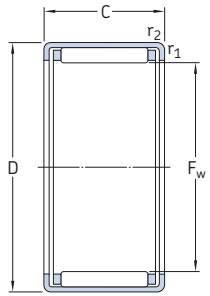
[1] For housings that are not rigid, the shaft tolerance giving the desired operational clearance must be determined by trial and error.
[2] The accuracy of cylindrical form to ISO 1101-2004 for the housing bore must correspond to IT5/2 tolerance grade.

Fig. 13

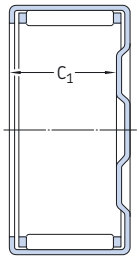
Mounting dolly



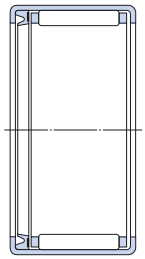
Drawn cup needle roller bearings
F_w **3 – 9** mm



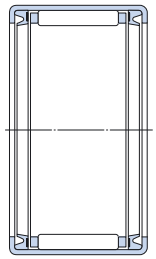
HK



BK



HK .. RS



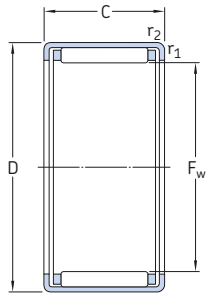
HK ...2RS

Principal dimensions			**Basic load ratings** dynamic	static	**Fatigue load limit**	**Speed ratings** Reference speed	Limiting speed	**Mass**	**Designation**
F_w	D	C	C	C_0	P_u				
mm			kN		kN	r/min		kg	–
3	6,5	6	1,23	0,88	0,088	24 000	26 000	0,0010	**HK 0306 TN**
	6,5	6	1,23	0,88	0,088	24 000	26 000	0,0010	**BK 0306 TN**
4	8	8	1,76	1,37	0,14	22 000	26 000	0,0020	**HK 0408**
	8	8	1,76	1,37	0,14	22 000	26 000	0,0021	**BK 0408**
5	9	9	2,38	2,08	0,22	22 000	24 000	0,0020	**HK 0509**
	9	9	2,38	2,08	0,22	22 000	24 000	0,0021	**BK 0509**
6	10	6	1,72	1,29	0,132	22 000	20 000	0,0015	**HK 0606**
	10	8	2,01	1,73	0,18	20 000	22 000	0,0021	**HK 0608**
	10	9	2,81	2,7	0,285	20 000	22 000	0,0025	**HK 0609**
	10	9	2,81	2,7	0,285	20 000	22 000	0,0026	**BK 0609**
7	11	9	3,03	3,05	0,325	20 000	22 000	0,0026	**HK 0709**
	11	9	3,03	3,05	0,325	20 000	22 000	0,0029	**BK 0709**
8	12	8	2,7	2,75	0,285	19 000	22 000	0,0027	**HK 0808**
	12	8	2,7	2,75	0,285	19 000	22 000	0,0030	**BK 0808**
	12	10	3,69	4,05	0,44	19 000	22 000	0,0030	**HK 0810**
	12	10	2,7	2,75	0,285	19 000	13 000	0,0030	**HK 0810 RS**
	12	10	2,3	2,04	0,208	13 000	19 000	0,0032	**HK 0810.2RS**
	12	10	3,69	4,05	0,44	19 000	22 000	0,0034	**BK 0810**
	12	12	3,69	4,05	0,44	13 000	19 000	0,0031	**HK 0812 RS**
	12	12	2,7	2,75	0,285	–	13 000	0,0033	**HK 0812.2RS**
9	13	8	3,52	3,9	0,415	20 000	20 000	0,0030	**HK 0908**
	13	10	4,13	4,8	0,53	18 000	20 000	0,0040	**HK 0910**
	13	10	4,13	4,8	0,53	18 000	20 000	0,0043	**BK 0910**
	13	12	5,12	6,4	0,72	18 000	20 000	0,0046	**HK 0912**
	13	12	5,12	6,4	0,72	18 000	20 000	0,0049	**BK 0912**

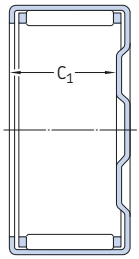
Dimensions			Appropriate inner ring[1] Designation	Appropriate seal[2] Designation
F_w	C_1 min	$r_{1,2}$ min		
mm				
3	–	0,3	–	–
	5,2	0,3	–	–
4	–	0,3	–	G 4×8×2 S
	6,4	0,3	–	G 4×8×2 S
5	–	0,4	–	G 5×9×2 S
	7,2	0,4	–	G 5×9×2 S
	–	0,4	–	G 6×10×2 S
6	–	0,4	–	G 6×10×2 S
	–	0,4	–	G 6×10×2 S
	7,4	0,4	–	G 6×10×2 S
7	–	0,4	–	G 7×11×2 S
	7,4	0,4	–	G 7×11×2 S
8	–	0,4	–	G 8×12×3
	6,4	0,4	–	G 8×12×3
	–	0,4	IR 5×8×12	G 8×12×3
	–	0,4	IR 5×8×12	–
	–	0,4	–	–
	8,4	0,4	IR 5×8×12	G 8×12×3
	–	0,4	–	–
	–	0,4	IR 5×8×16	–
9	–	0,4	–	G 9×13×3
	–	0,4	IR 6×9×12	G 9×13×3
	8,2	0,4	IR 6×9×12	G 9×13×3
	–	0,4	IR 6×9×12	G 9×13×3
	10,4	0,4	IR 6×9×12	G 9×13×3

[1] For additional information, refer to the section *Needle roller bearing inner rings*, starting on **page 196**.
[2] For additional information, refer to the section *Radial shaft seals with a low cross sectional height*, starting on **page 208**.

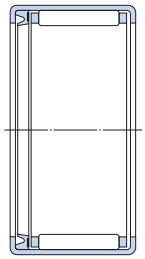
Drawn cup needle roller bearings
F_w **10 – 14** mm



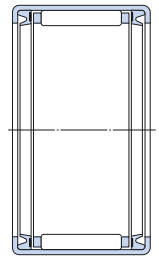
HK



BK

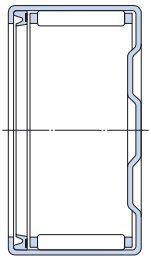


HK .. RS

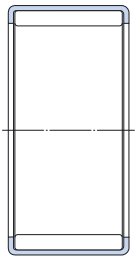


HK ...2RS

Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation
F_w	D	C	C	C_0	P_u				
mm			kN		kN	r/min		kg	–
10	14	10	4,29	5,3	0,57	18 000	20 000	0,0041	**HK 1010**
	14	10	6,82	11,4	1,27	18 000	14 000	0,0046	**HN 1010**
	14	10	4,29	5,3	0,57	18 000	20 000	0,0043	**BK 1010**
	14	12	5,39	6,95	0,78	18 000	20 000	0,0048	**HK 1012**
	14	12	4,29	5,3	0,57	18 000	12 000	0,0042	**HK 1012 RS**
	14	12	3,19	3,55	0,365	12 000	18 000	0,0043	**HK 1012.2RS**
	14	12	5,39	6,95	0,78	18 000	20 000	0,0050	**BK 1012**
	14	12	4,29	5,3	0,57	12 000	18 000	0,0043	**BK 1012 RS**
	14	14	4,29	5,3	0,57	–	12 000	0,0046	**HK 1014.2RS**
	14	15	6,6	9	1,02	18 000	20 000	0,0060	**HK 1015**
	14	15	6,6	9	1,02	18 000	20 000	0,0062	**BK 1015**
12	16	10	4,84	6,4	0,71	16 000	18 000	0,0046	**HK 1210**
	16	10	7,48	13,7	1,53	17 000	13 000	0,0053	**HN 1210**
	16	10	4,84	6,4	0,71	16 000	18 000	0,0052	**BK 1210**
	18	12	6,27	7,35	0,85	16 000	18 000	0,0090	**HK 1212**
	18	12	9,52	15,3	1,76	17 000	13 000	0,011	**HN 1212**
	18	12	6,27	7,35	0,85	16 000	18 000	0,010	**BK 1212**
	18	14	6,27	7,35	0,85	16 000	10 000	0,010	**HK 1214 RS**
	16	14	4,84	6,4	0,71	10 000	16 000	0,0080	**HK 1214.2RS**
	18	16	6,27	7,35	0,85	–	10 000	0,011	**HK 1216.2RS**
13	19	12	6,6	8	0,915	16 000	17 000	0,010	**HK 1312**
	19	12	6,6	8	0,915	16 000	17 000	0,011	**BK 1312**
14	20	12	6,82	8,65	0,98	15 000	17 000	0,011	**HK 1412**
	20	12	10,5	17,6	2,04	15 000	12 000	0,012	**HN 1412**
	20	12	6,82	8,65	0,98	15 000	17 000	0,012	**BK 1412**
	20	14	6,82	8,65	0,98	15 000	9 500	0,012	**HK 1414 RS**
	20	14	6,82	8,65	0,98	15 000	9 500	0,013	**BK 1414 RS**
	20	16	6,82	8,65	0,98	–	9 500	0,013	**HK 1416.2RS**



BK .. RS

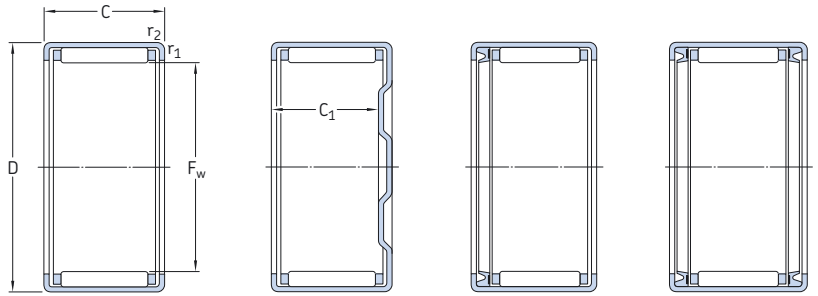


HN

Dimensions			Appropriate inner ring[1] Designation	Appropriate seal[2] Designation
F_w	C_1 min	$r_{1,2}$ min		
mm				
10	–	0,4	LR/IR 7×10×10.5	G 10×14×3
	–	0,4	LR/IR 7×10×10.5	G 10×14×3
	8,4	0,4	LR/IR 7×10×10.5	G 10×14×3
	–	0,4	IR 7×10×12	G 10×14×3
	–	0,4	IR 7×10×12	–
	–	0,4	–	–
	10,4	0,4	IR 7×10×12	G 10×14×3
	10,4	0,4	–	–
	–	0,4	IR 7×10×16	–
	–	0,4	IR 7×10×16	G 10×14×3
	13,4	0,4	IR 7×10×16	G 10×14×3
12	–	0,4	LR/IR 8×12×10.5	G 12×16×3
	–	0,4	LR/IR 8×12×10.5	G 12×16×3
	8,4	0,4	LR/IR 8×12×10.5	G 12×16×3
	–	0,8	LR/IR 8×12×12.5	G/SD 12×18×3
	–	0,8	LR/IR 8×12×12.5	G/SD 12×18×3
	9,3	0,8	LR/IR 8×12×12.5	G/SD 12×18×3
	–	0,8	–	–
	–	0,4	–	–
	–	0,8	IR 9×12×16	–
13	–	0,8	LR/IR 10×13×12.5	G 13×19×3
	9,3	0,8	LR/IR 10×13×12.5	G 13×19×3
14	–	0,8	IR 10×14×13	G/SD 14×20×3
	–	0,8	IR 10×14×13	G/SD 14×20×3
	9,3	0,8	IR 10×14×13	G/SD 14×20×3
	–	0,8	IR 10×14×16	–
	11,3	0,8	IR 10×14×13	–
	–	0,8	IR 10×14×20	–

[1] For additional information, refer to the section *Needle roller bearing inner rings*, starting on **page 196**.
[2] For additional information, refer to the section *Radial shaft seals with a low cross sectional height*, starting on **page 208**.

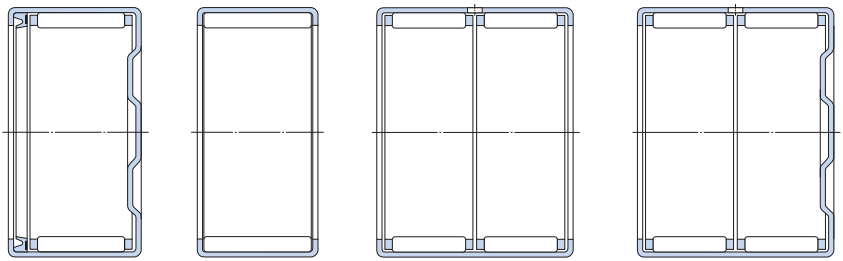
Drawn cup needle roller bearings
F_w **15 – 18** mm



HK BK HK .. RS HK ...2RS

Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation
F_w	D	C	C	C_0	P_u				
mm			kN		kN	r/min		kg	–
15	21	12	7,65	9,5	1,08	15 000	16 000	0,011	**HK 1512**
	21	12	7,65	9,5	1,08	15 000	16 000	0,013	**BK 1512**
	21	14	7,48	10	1,14	15 000	9 500	0,012	**HK 1514 RS**
	21	16	10,1	14,6	1,7	15 000	16 000	0,015	**HK 1516**
	21	16	7,48	10	1,14	–	9 500	0,015	**HK 1516.2RS**
	21	16	14,5	28	3,25	15 000	12 000	0,014	**HN 1516**
	21	16	10,1	14,6	1,7	15 000	16 000	0,017	**BK 1516**
	21	18	10,1	14,6	1,7	15 000	9 500	0,016	**HK 1518 RS**
	21	20	10,1	14,6	1,7	–	9 500	0,018	**HK 1520.2RS**
	21	22	13	20	2,28	15 000	16 000	0,020	**HK 1522**[1]
16	22	12	7,37	9,8	1,12	14 000	16 000	0,012	**HK 1612**
	22	12	11,2	20,4	2,32	15 000	12 000	0,013	**HN 1612**
	22	12	7,37	9,8	1,12	14 000	16 000	0,014	**BK 1612**
	22	14	7,37	9,8	1,12	14 000	9 000	0,013	**HK 1614 RS**
	22	14	7,37	9,8	1,12	14 000	9 000	0,015	**BK 1614 RS**
	22	16	10,5	15,6	1,8	14 000	16 000	0,016	**HK 1616**
	22	16	7,37	9,8	1,12	–	9 000	0,014	**HK 1616.2RS**
	22	16	10,5	15,6	1,8	14 000	16 000	0,018	**BK 1616**
	22	20	11	14,6	1,66	–	9 000	0,018	**HK 1620.2RS**
	22	22	12,8	19,6	2,24	14 000	16 000	0,022	**HK 1622**[1]
	22	22	12,8	19,6	2,24	14 000	16 000	0,024	**BK 1622**[1]
17	23	12	7,65	10,6	1,2	14 000	15 000	0,012	**HK 1712**
18	24	12	7,92	11,2	1,27	13 000	15 000	0,013	**HK 1812**
	24	12	7,92	11,2	1,27	13 000	15 000	0,015	**BK 1812**
	24	14	7,92	11,2	1,27	13 000	8 500	0,014	**HK 1814 RS**
	24	16	11,2	17,6	2,04	13 000	15 000	0,018	**HK 1816**
	24	16	7,92	11,2	1,27	–	8 500	0,015	**HK 1816.2RS**
	24	16	16,1	33,5	3,8	14 000	11 000	0,020	**HN 1816**
	24	16	11,2	17,6	2,04	13 000	15 000	0,020	**BK 1816**

[1] Double row, outer ring with a lubrication hole

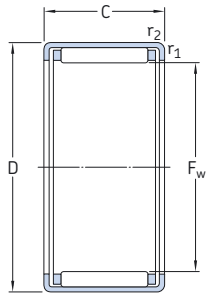


BK .. RS | HN | HK (double row) | BK (double row)

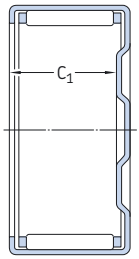
Dimensions			Appropriate inner ring[1] Designation	Appropriate seal[2] Designation
F_w	C_1 min	$r_{1,2}$ min		
mm				
15	–	0,8	LR/IR 12×15×12.5	G/SD 15×21×3
	9,3	0,8	LR/IR 12×15×12.5	G/SD 15×21×3
	–	0,8	LR/IR 12×15×16.5	–
	–	0,8	LR/IR 12×15×16.5	G/SD 15×21×3
	–	0,8	LR/IR 12×15×16.5	–
	–	0,8	LR/IR 12×15×16.5	G/SD 15×21×3
	13,3	0,8	LR/IR 12×15×16.5	G/SD 15×21×3
	–	0,8	–	–
	–	0,8	LR/IR 12×15×22.5	–
	–	0,8	LR/IR 12×15×22.5	G/SD 15×21×3
16	–	0,8	IR 12×16×13	G/SD 16×22×3
	–	0,8	IR 12×16×13	G/SD 16×22×3
	9,3	0,8	IR 12×16×13	G/SD 16×22×3
	–	0,8	IR 12×16×16	–
	11,3	0,8	IR 12×16×13	–
	–	0,8	IR 12×16×16	G/SD 16×22×3
	–	0,8	IR 12×16×20	–
	13,3	0,8	IR 12×16×16	G/SD 16×22×3
	–	0,8	IR 12×16×22	–
	–	0,8	IR 12×16×22	G/SD 16×22×3
	19,3	0,8	IR 12×16×22	G/SD 16×22×3
17	–	0,8	–	G/SD 17×23×3
18	–	0,8	LR 15×18×12.5	G/SD 18×24×3
	9,3	0,8	LR 15×18×12.5	G/SD 18×24×3
	–	0,8	LR/IR 15×18×16.5	–
	–	0,8	LR/IR 15×18×16.5	G/SD 18×24×3
	–	0,8	LR/IR 15×18×16.5	–
	–	0,8	LR/IR 15×18×16.5	G/SD 18×24×3
	13,3	0,8	LR/IR 15×18×16.5	G/SD 18×24×3

[1] For additional information, refer to the section *Needle roller bearing inner rings*, starting on **page 196**.
[2] For additional information, refer to the section *Radial shaft seals with a low cross sectional height*, starting on **page 208**.

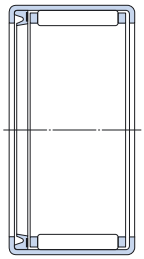
Drawn cup needle roller bearings
F_w **20 – 22** mm



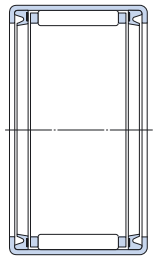
HK



BK



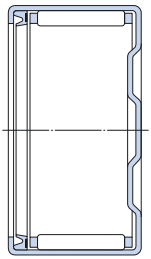
HK .. RS



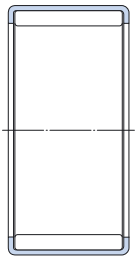
HK ...2RS

Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation
F_w	D	C	C	C_0	P_u				
mm			kN		kN	r/min		kg	–
20	26	10	6,16	8,5	0,93	12 000	14 000	0,012	**HK 2010**
	26	12	8,42	12,5	1,4	12 000	14 000	0,014	**HK 2012**
	26	16	12,3	20,4	2,36	12 000	14 000	0,019	**HK 2016**
	26	16	8,42	12,5	1,4	–	8 000	0,018	**HK 2016.2RS**
	26	16	16,8	36,5	4,25	12 000	10 000	0,022	**HN 2016**
	26	16	12,3	20,4	2,36	12 000	14 000	0,022	**BK 2016**
	26	18	12,3	20,4	2,36	12 000	8 000	0,021	**HK 2018 RS**
	26	18	12,3	20,4	2,36	12 000	8 000	0,024	**BK 2018 RS**
	26	20	15,1	26,5	3,15	12 000	14 000	0,024	**HK 2020**
	26	20	12,3	20,4	2,36	–	8 000	0,023	**HK 2020.2RS**
	26	20	20,9	48	5,7	12 000	10 000	0,030	**HN 2020**
	26	20	15,1	26,5	3,15	12 000	14 000	0,027	**BK 2020**[1)]
	26	30	20,9	40,5	4,75	12 000	14 000	0,035	**HK 2030**[1)]
22	28	10	7,21	10,6	1,2	11 000	12 000	0,013	**HK 2210**
	28	12	8,8	13,7	1,56	11 000	12 000	0,015	**HK 2212**
	28	12	8,8	13,7	1,56	11 000	12 000	0,018	**BK 2212**
	28	14	8,8	13,7	1,56	11 000	7 500	0,016	**HK 2214 RS**
	28	16	13	22,4	2,6	11 000	12 000	0,021	**HK 2216**
	28	16	8,8	13,7	1,56	–	7 500	0,018	**HK 2216.2RS**
	28	16	13	22,4	2,6	11 000	12 000	0,024	**BK 2216**
	28	18	13	22,4	2,6	11 000	7 500	0,024	**HK 2218 RS**
	28	20	15,7	29	3,45	11 000	12 000	0,026	**HK 2220**
	28	20	13	22,4	2,6	–	7 500	0,026	**HK 2220.2RS**

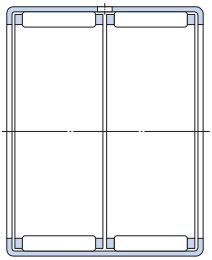
[1)] Double row, outer ring with a lubrication hole



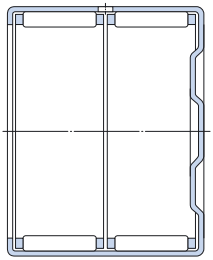
BK .. RS



HN



HK
(double row)

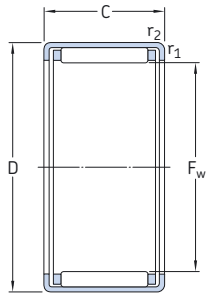


BK
(double row)

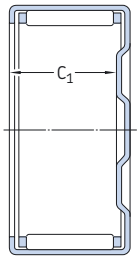
Dimensions			Appropriate inner ring[1] Designation	Appropriate seal[2] Designation
F_w	C_1 min	$r_{1,2}$ min		
mm				
20	–	0,8	IR 15×20×12 IS1	G/SD 20×26×4
	–	0,8	IR 15×20×13	G/SD 20×26×4
	–	0,8	LR/IR 17×20×16.5	G/SD 20×26×4
	–	0,8	LR/IR 17×20×16.5	–
	–	0,8	LR/IR 17×20×16.5	G/SD 20×26×4
	13,3	0,8	LR/IR 17×20×16.5	G/SD 20×26×4
	–	0,8	LR/IR 17×20×20.5	–
	15,3	0,8	LR/IR 17×20×16.5	–
	–	0,8	LR/IR 17×20×20.5	G/SD 20×26×4
	–	0,8	LR/IR 17×20×20.5	–
	–	0,8	LR/IR 17×20×20.5	G/SD 20×26×4
	17,3	0,8	LR/IR 17×20×20.5	G/SD 20×26×4
	–	0,8	LR/IR 17×20×30.5	G/SD 20×26×4
22	–	0,8	IR 17×22×13	G/SD 22×28×4
	–	0,8	IR 17×22×13	G/SD 22×28×4
	9,3	0,8	IR 17×22×13	G/SD 22×28×4
	–	0,8	IR 17×22×16	–
	–	0,8	IR 17×22×16	G/SD 22×28×4
	–	0,8	IR 17×22×23	–
	13,3	0,8	IR 17×22×16	G/SD 22×28×4
	–	0,8	IR 17×22×23	–
	–	0,8	IR 17×22×23	G/SD 22×28×4
	–	0,8	IR 17×22×23	–

[1] For additional information, refer to the section *Needle roller bearing inner rings*, starting on **page 196**.
[2] For additional information, refer to the section *Radial shaft seals with a low cross sectional height*, starting on **page 208**.

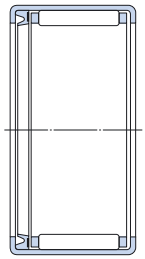
Drawn cup needle roller bearings
F_w **25 – 30** mm



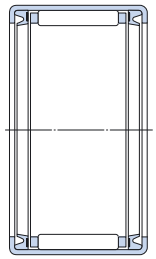
HK



BK



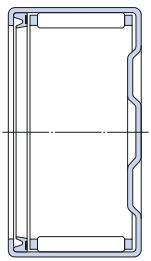
HK .. RS



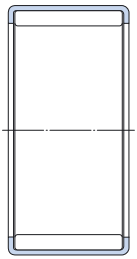
HK ...2RS

Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation
F_w	D	C	C	C_0	P_u				
mm			kN		kN	r/min		kg	–
25	32	12	10,5	15,3	1,76	9 500	11 000	0,020	**HK 2512**
	32	16	15,1	24	2,85	9 500	11 000	0,027	**HK 2516**
	32	16	10,5	15,3	1,76	–	6 700	0,027	**HK 2516.2RS**
	32	16	15,1	24	2,85	11 000	9 500	0,032	**BK 2516**
	32	18	15,1	24	2,85	9 500	6 700	0,029	**HK 2518 RS**
	32	18	15,1	24	2,85	9 500	6 700	0,034	**BK 2518 RS**
	32	20	19	32,5	4	9 500	11 000	0,033	**HK 2520**
	32	20	15,1	24	2,85	–	6 700	0,031	**HK 2520.2RS**
	32	20	26,4	60	7,2	10 000	8 000	0,040	**HN 2520**
	32	20	19	32,5	4	9 500	11 000	0,038	**BK 2520**
	32	24	19	32,5	4	–	6 700	0,040	**HK 2524.2RS**
	32	26	24,2	45	5,5	9 500	11 000	0,044	**HK 2526**
	32	26	24,2	45	5,5	9 500	11 000	0,048	**BK 2526**
	32	30	24,2	45	5,5	–	6 700	0,047	**HK 2530.2RS**
	32	38	33	65,5	8	9 500	11 000	0,064	**HK 2538**[1]
	32	38	33	65,5	8	9 500	11 000	0,068	**BK 2538**[1]
28	35	16	15,7	26,5	3,15	9 000	9 500	0,029	**HK 2816**
	35	18	15,7	26,5	3,15	6 300	9 000	0,031	**HK 2818 RS**
	35	20	20,1	36,5	4,4	9 000	9 500	0,036	**HK 2820**
	35	20	15,7	26,5	3,15	–	6 300	0,034	**HK 2820.2RS**
	35	20	28,1	68	8,15	9 000	7 000	0,044	**HN 2820**
30	37	12	11,7	18,3	2,12	8 000	9 000	0,023	**HK 3012**
	37	12	11,7	18,3	2,12	8 000	9 000	0,028	**BK 3012**
	37	16	16,5	29	3,4	8 000	9 000	0,031	**HK 3016**
	37	16	11,7	18,3	2,12	–	5 600	0,031	**HK 3016.2RS**
	37	16	16,5	29	3,4	8 000	9 000	0,038	**BK 3016**
	37	18	16,5	29	3,4	8 000	5 600	0,037	**HK 3018 RS**
	37	20	20,9	40	4,75	8 000	9 000	0,039	**HK 3020**
	37	20	16,5	29	3,4	–	5 600	0,036	**HK 3020.2RS**
	37	20	20,9	40	4,75	8 000	9 000	0,047	**BK 3020**
	37	22	23,8	46,5	5,6	9 000	8 000	0,042	**HK 3022**
	37	24	20,9	40	4,75	–	5 600	0,044	**HK 3024.2RS**
	37	26	27	54	6,55	8 000	9 000	0,051	**HK 3026**
	37	26	27	54	6,55	8 000	9 000	0,058	**BK 3026**
	37	38	35,8	80	9,5	8 000	9 000	0,076	**HK 3038**[1]
	37	38	35,8	80	9,5	8 000	9 000	0,084	**BK 3038**[1]

[1] Double row, outer ring with a lubrication hole



BK .. RS



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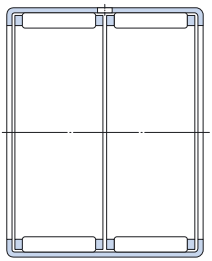
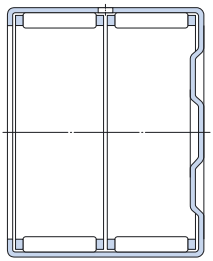


HK
(double row)

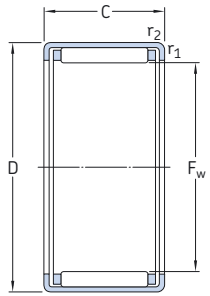


BK
(double row)

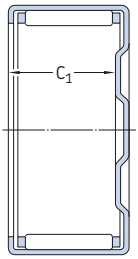
Dimensions			Appropriate inner ring[1] Designation	Appropriate seal[2] Designation
F_w	C_1 min	$r_{1,2}$ min		
mm				
25	–	0,8	LR 20×25×12.5	G 25×32×4
	–	0,8	LR 20×25×16.5 / IR 20×25×17	G 25×32×4
	–	0,8	LR 20×25×16.5 / IR 20×25×17	–
	23,3	0,8	–	–
	–	0,8	LR/IR 20×25×20.5	–
	15,3	0,8	LR 20×25×16.5 / IR 20×25×17	–
	–	0,8	LR/IR 20×25×20.5	G 25×32×4
	–	0,8	LR/IR 20×25×20.5	–
	–	0,8	LR/IR 20×25×20.5	G 25×32×4
	17,3	0,8	LR/IR 20×25×20.5	G 25×32×4
	–	0,8	LR/IR 20×25×26.5	–
	–	0,8	LR/IR 20×25×26.5	G 25×32×4
	23,3	0,8	LR/IR 20×25×26.5	G 25×32×4
	–	0,8	IR 20×25×30	–
	–	0,8	LR/IR 20×25×38.5	G 25×32×4
	35,3	0,8	LR/IR 20×25×38.5	G 25×32×4
28	–	0,8	IR 22×28×17	G/SD 28×35×4
	–	0,8	LR/IR 22×28×20.5	–
	–	0,8	LR/IR 22×28×20.5	G/SD 28×35×4
	–	0,8	LR/IR 22×28×20.5	–
	–	0,8	LR/IR 22×28×20.5	G/SD 28×35×4
30	–	0,8	LR 25×30×12.5	G/SD 30×37×4
	9,3	0,8	LR 25×30×12.5	G/SD 30×37×4
	–	0,8	LR 25×30×16.5 / IR 25×30×17	G/SD 30×37×4
	–	0,8	LR 25×30×16.5 / IR 25×30×17	–
	13,3	0,8	LR 25×30×16.5 / IR 25×30×17	G/SD 30×37×4
	–	0,8	LR/IR 25×30×20.5	–
	–	0,8	LR/IR 25×30×20.5	G/SD 30×37×4
	–	0,8	LR/IR 25×30×20.5	–
	17,3	0,8	LR/IR 25×30×20.5	G/SD 30×37×4
	–	0,8	–	G/SD 30×37×4
	–	0,8	LR/IR 25×30×26.5	–
	–	0,8	LR/IR 25×30×26.5	G/SD 30×37×4
	23,3	0,8	LR/IR 25×30×26.5	G/SD 30×37×4
	–	0,8	LR/IR 25×30×38.5	G/SD 30×37×4
	35,3	0,8	LR/IR 25×30×38.5	G/SD 30×37×4

[1] For additional information, refer to the section *Needle roller bearing inner rings*, starting on **page 196**.
[2] For additional information, refer to the section *Radial shaft seals with a low cross sectional height*, starting on **page 208**.

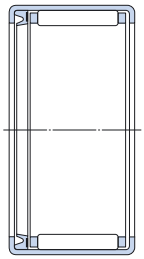
Drawn cup needle roller bearings
F_w **32 – 50** mm



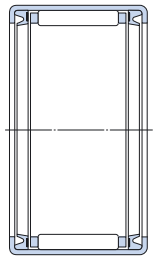
HK



BK

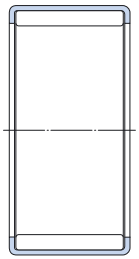


HK .. RS



HK ...2RS

Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation
F_w	D	C	C	C_0	P_u				
mm			kN		kN	r/min		kg	–
32	39	20	22	43	5,2	8 500	7 500	0,041	**HK 3220**
	39	24	26,4	54	6,55	8 500	7 500	0,049	**HK 3224**
35	42	12	12,5	21,6	2,45	7 000	8 000	0,027	**HK 3512**
	42	16	17,9	34	4	7 000	8 000	0,036	**HK 3516**
	42	16	12,5	21,6	2,45	–	5 000	0,032	**HK 3516.2RS**
	42	18	17,9	34	4	7 000	5 000	0,039	**HK 3518 RS**
	42	20	22,9	46,5	5,6	7 000	8 000	0,044	**HK 3520**
	42	20	17,9	34	4	–	5 000	0,041	**HK 3520.2RS**
	42	20	31,4	83	10,2	7 500	6 000	0,054	**HN 3520**
	42	20	22,9	46,5	5,6	7 000	8 000	0,053	**BK 3520**
40	47	12	13,4	24,5	2,8	6 300	7 000	0,030	**HK 4012**
	47	16	19	39	4,55	6 300	7 000	0,039	**HK 4016**
	47	16	13,4	24,5	2,8	–	4 500	0,037	**HK 4016.2RS**
	47	18	19	39	4,55	6 300	4 500	0,045	**HK 4018 RS**
	47	20	24,2	53	6,4	6 300	7 000	0,054	**HK 4020**
	47	20	19	39	4,55	–	4 500	0,048	**HK 4020.2RS**
	47	20	33,6	95	11,6	6 300	5 000	0,061	**HN 4020**
	47	20	24,2	53	6,4	6 300	7 000	0,062	**BK 4020**
45	52	12	14,2	27,5	3,2	5 600	6 300	0,033	**HK 4512**
	52	16	20,5	43	5,1	5 600	6 300	0,046	**HK 4516**
	52	18	20,5	43	5,1	5 600	4 000	0,050	**HK 4518 RS**
	52	20	26	60	7,2	5 600	6 300	0,056	**HK 4520**
	52	20	20,5	43	5,1	–	4 000	0,054	**HK 4520.2RS**
	52	20	35,8	108	13,2	5 600	4 500	0,066	**HN 4520**
	52	20	26	60	7,2	5 600	6 300	0,072	**BK 4520**
	52	25	44	140	17	5 600	4 500	0,085	**HN 4525**
50	58	20	29,2	63	7,8	5 000	5 600	0,070	**HK 5020**
	58	20	41,8	120	14,3	5 000	4 000	0,085	**HN 5020**
	58	22	29,2	63	7,8	5 000	3 600	0,076	**HK 5022 RS**
	58	24	29,2	63	7,8	–	3 600	0,081	**HK 5024.2RS**
	58	25	36,9	85	10,6	5 000	5 600	0,090	**HK 5025**
	58	25	50,1	153	18,6	5 000	4 000	0,11	**HN 5025**

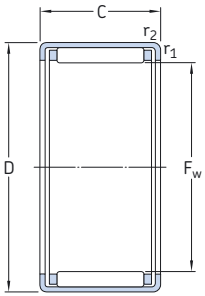


HN

Dimensions			Appropriate inner ring[1] Designation	Appropriate seal[2] Designation
F_w	C_1 min	$r_{1,2}$ min		
mm				
32	–	0,8	–	–
	–	0,8	–	–
35	–	0,8	LR 30×35×12.5	G/SD 35×42×4
	–	0,8	LR 30×35×16.5 / IR 30×35×17	G/SD 35×42×4
	–	0,8	LR 30×35×16.5 / IR 30×35×17	–
	–	0,8	LR/IR 30×35×20.5	–
	–	0,8	LR/IR 30×35×20.5	G/SD 35×42×4
	–	0,8	LR/IR 30×35×20.5	–
	–	0,8	LR/IR 30×35×20.5	G/SD 35×42×4
	17,3	0,8	LR/IR 30×35×20.5	G/SD 35×42×4
40	–	0,8	LR 35×40×12.5	G/SD 40×47×4
	–	0,8	LR 35×40×16.5 / IR 35×40×17	G/SD 40×47×4
	–	0,8	LR 35×40×16.5 / IR 35×40×17	–
	–	0,8	LR/IR 35×40×20.5	–
	–	0,8	LR/IR 35×40×20.5	G/SD 40×47×4
	–	0,8	LR/IR 35×40×20.5	–
	–	0,8	LR/IR 35×40×20.5	G/SD 40×47×4
	17,3	0,8	LR/IR 35×40×20.5	G/SD 40×47×4
45	–	0,8	–	G/SD 45×52×4
	–	0,8	LR 40×45×16.5 / IR 40×45×17	G/SD 45×52×4
	–	0,8	LR/IR 40×45×20.5	–
	–	0,8	LR/IR 40×45×20.5	G/SD 45×52×4
	–	0,8	LR/IR 40×45×20.5	–
	–	0,8	LR/IR 40×45×20.5	G/SD 45×52×4
	17,3	0,8	LR/IR 40×45×20.5	G/SD 45×52×4
	–	0,8	–	G/SD 45×52×4
50	–	0,8	LR 45×50×20.5 / IR 40×50×20 IS1	G/SD 50×58×4
	–	0,8	LR/IR 40×50×20 IS1	G/SD 50×58×4
	–	0,8	LR/IR 45×50×25.5	–
	–	0,8	LR/IR 45×50×25.5	–
	–	0,8	LR/IR 45×50×25.5	G/SD 50×58×4
	–	0,8	LR/IR 45×50×25.5	G/SD 50×58×4

[1] For additional information, refer to the section *Needle roller bearing inner rings*, starting on **page 196**.
[2] For additional information, refer to the section *Radial shaft seals with a low cross sectional height*, starting on **page 208**.

Drawn cup needle roller bearings
F_w **55 – 60** mm



HK

Principal dimensions			**Basic load ratings** dynamic	static	**Fatigue load limit**	**Speed ratings** Reference speed	Limiting speed	**Mass**	**Designation**
F_w	D	C	C	C_0	P_u				
mm			kN		kN	r/min		kg	–
55	63	20	30,3	67	8,3	4 500	5 000	0,074	**HK 5520**
	63	28	41,8	104	12,9	4 500	5 000	0,11	**HK 5528**
60	68	12	17,6	32	3,8	4 300	4 800	0,049	**HK 6012**
	68	20	31,9	75	9,3	4 300	4 800	0,081	**HK 6020**
	68	32	51,2	137	17	4 300	4 800	0,14	**HK 6032**

Dimensions		Appropriate inner ring[1] Designation	Appropriate seal[2] Designation
F_w	$r_{1,2}$ min		
mm			
55	0,8	LR 50×55×20.5	G 55×63×5
	0,8	–	G 55×63×5
60	0,8	–	–
	0,8	–	–
	0,8	–	–

[1] For additional information, refer to the section *Needle roller bearing inner rings*, starting on **page 196**.
[2] For additional information, refer to the section *Radial shaft seals with a low cross sectional height*, starting on **page 208**.


SKF

Needle roller bearings with machined rings

Needle roller bearings with machined rings made of carbon chromium bearing steel have a low sectional height and a very high load carrying capacity for their size. They may be used with or without an inner ring, depending on the application.

Needle roller bearings without an inner ring (→ **fig. 1**) are an excellent choice for compact bearing arrangements if the shaft can be hardened and ground. Eliminating the need for a separate inner ring enables a larger shaft diameter and a stiffer arrangement. Axial displacement of the shaft relative to the housing is only limited by the width of the raceway on the shaft. By machining the shaft raceways to the appropriate dimensional and form accuracy, it is possible to obtain bearing arrangements with heightened running accuracy. For additional information, refer to the section *Raceways on shafts and in housings* on **page 50** and to *Internal clearance* on **page 42**.

Needle roller bearings with an inner ring (→ **fig. 2**) are used for arrangements where it is not possible or uneconomical to harden and grind the shaft. Bearings with an inner ring only permit axial displacement of the shaft relative to the housing within certain limits. If the permissible axial displacement provided by a standard inner ring is insufficient, it is possible to use an extended inner ring. Extended inner rings can also provide an excellent counterface for the lips of external G or SD seals. For additional information, refer to the section *Needle roller bearing components*, starting on **page 195**.

SKF supplies needle roller bearings in several designs and sizes:

- with flanges (closure rings or integral flanges) on the outer ring (→ **figs. 3** and **4**), sealed (→ **fig. 5**) or not sealed and with or without an inner ring
- without flanges on the outer ring (→ **fig. 6**), not sealed and with or without an inner ring

To accommodate combined radial and axial loads, needle roller bearings of certain sizes can be combined with needle roller thrust bearings with a centring spigot, AXW series (→ **fig. 7**).

Fig. 1

Needle roller bearing without an inner ring

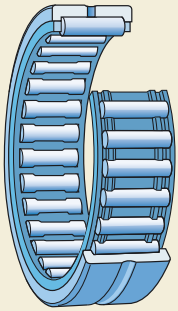


Fig. 2

Needle roller bearing with an inner ring

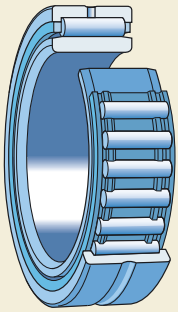


Fig. 3

Needle roller bearing with inserted closure rings (for bearings with $F_w \leq 10$ mm)

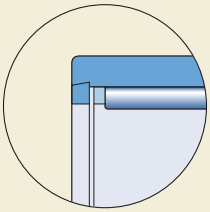


Fig. 4

Needle roller bearing with integral outer ring flanges (for bearings with $F_w \geq 12$ mm)

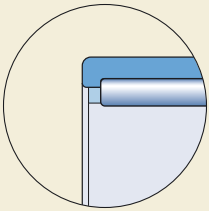


Fig. 5

Needle roller bearing, sealed

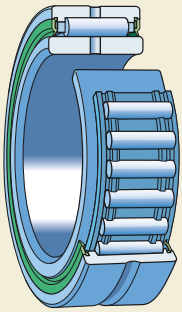


Fig. 6

Needle roller bearing without flanges on the outer ring

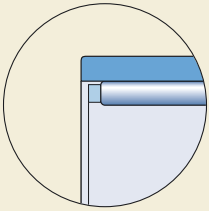
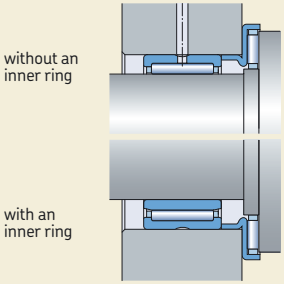


Fig. 7

Needle roller bearing combined with a needle roller thrust bearing, AXW series

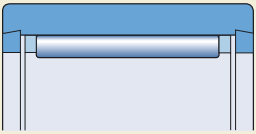


Needle roller bearings with machined rings with flanges

SKF needle roller bearings with flanges on the outer ring and with an outside diameter up to and including 17 mm ($F_w \leq 10$ mm), are manufactured with inserted closure rings. These bearings do not have a lubrication hole or an annular groove (→ **fig. 8**). Larger bearings have integral flanges on the outer ring, an annular groove and, depending on the bearing size, one or more lubrication holes in the outer ring (→ **fig. 9**). Needle roller bearings with flanges are generally designed as single row bearings. Bearings in the RNA 69 and NA 69 series, with an outside diameter D ≥ 52 mm, have two needle roller and cage assemblies (→ **fig. 10**). The outer ring and cage assembly of a needle roller bearing with flanges form a non-separable unit.

Fig. 8

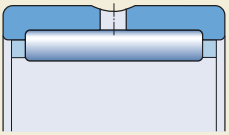
Design with inserted closure rings, without a lubrication hole



NK series ($F_w \leq 10$ mm)

Fig. 9

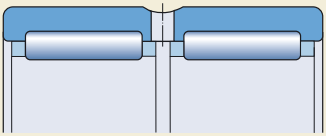
Design with integral flanges, with a lubrication hole and an annular groove



NK series ($F_w \geq 12$ mm)
NKS series
RNA 48 series
RNA 49 series
RNA 69 series (D ≤ 47 mm)

Fig. 10

Needle roller bearing, double row



RNA series (D ≥ 52 mm)

Sealed bearings

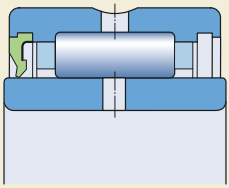
Single row bearings, in the RNA 49 and NA 49 series, are also available with a contact seal on one (→ **fig. 11**) or both sides (→ **fig. 12**). The seals are made of acrylonitrile-butadiene rubber (NBR) that efficiently protects the bearing against the entry of contaminants and retains the lubricant in the bearing.

The operating temperature range for sealed needle roller bearings with machined rings, which is limited by the seal material and the grease fill, is –20 °C to +100 °C.

The inner ring of sealed bearings is 1 mm wider than the outer ring. This maintains the efficiency of the seals even when a small amount of axial displacement occurs.

Fig. 11

Needle roller bearing, sealed on one side



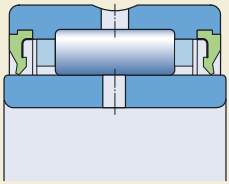
NA 49.. RS series

Initial grease fill and relubrication

Sealed needle roller bearings with machined rings are filled at the factory with a high-quality grease with good rust inhibiting properties. Because these bearings can hold a relatively large quantity of grease, they can be operated for long periods before relubrication is required. The lubrication groove and lubrication hole in the outer ring enable the lubricant to reach the bearing cavity during relubrication. The inner ring is also provided with a lubrication hole so that the bearing can be relubricated either via the outer or inner ring, depending on the application. SKF recommends SKF LGWA 2 grease for relubrication. For additional information about greases, refer to the section *Lubrication*, starting on **page 52**.

Fig. 12

Needle roller bearing, sealed on both sides



NA 49...2RS series

External seals

SKF supplies an assortment of radial shaft seals that can be used as external seals. Extended inner rings can be used if the inner ring raceway is to serve as a counterface for a seal adjacent to the bearing. Appropriate seals are listed in the product tables, when available. For additional information, refer to the section *Needle roller bearing components*, starting on **page 195**.

Needle roller bearings with machined rings without flanges

Needle roller bearings without flanges are completely separable, i.e. the outer ring, the needle roller and cage assembly and the inner ring can all be mounted separately. In many applications, this makes mounting a great deal easier. The needle roller and cage assembly can either be mounted together with the outer ring or with the shaft or inner ring, depending on the arrangement design. It can also be inserted between the outer ring and shaft or inner ring as the final step. However, needle roller and cage assemblies and bearing outer rings must always be kept together as supplied.

SKF needle roller bearings without flanges are available as single row (→ **fig. 13**) or double row bearings (→ **fig. 14**). Double row bearings have two needle roller and cage assemblies arranged adjacent to each other. They have an annular groove and a lubrication hole in the outer ring to enable efficient lubrication.

To provide efficient lubrication for needle roller bearings with an inner ring, SKF supplies some bearings with one lubrication hole in the inner ring. These bearings are listed in the product table. The cage of needle roller bearings without flanges must be axially guided by fine turned and burr-free surfaces on adjacent machine components. Recommended dimensions for these surfaces are listed in the product tables.

Dimensions

The boundary dimensions of SKF needle roller bearings with machined rings in the RNA 48, RNA 49, RNA 69, NA 48, NA 49 and NA 69 series are in accordance with ISO 1206-2001. The dimensions of the other needle roller bearings do not adhere to any national or international standards, but are common in the market.

Tolerances

SKF supplies needle roller bearings with machined rings to Normal tolerances in accordance with ISO 492:2002, as standard.

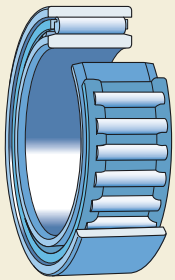
On request, needle roller bearings with higher accuracy to tolerance P6 or P5 specifications can be supplied. For bearing arrangements with higher accuracy, inner rings with a pre-ground raceway and a machining allowance can be supplied, but must be finish ground after mounting.

The inside diameter F_w of the needle roller and cage assembly, when the rollers are in contact with the outer ring raceway, lies within the limits of F6 tolerance class (→ **table 1**) before the bearings are mounted.

On request, SKF supplies needle roller bearings without an inner ring and with reduced inside diameter tolerances. These bearings are identified by the designation suffix H followed by a figure combination that gives the actual maximum and minimum values in µm for the deviation from the nominal inside diameter F_w, e.g. H+24+20.

Fig. 13

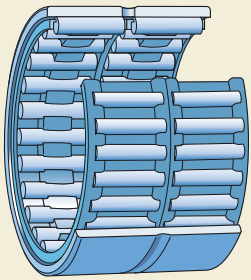
Needle roller bearing, single row, with an inner ring



NA0 series

Fig. 14

Needle roller bearing, double row, without an inner ring



RNA0 series

Internal clearance

SKF needle roller bearings with an inner ring have Normal radial internal clearance as standard. The clearance values are listed in **table 7** on **page 42** and are in accordance with ISO 5753:1991. They are valid for unmounted bearings under zero measuring load.

For needle roller bearings without an inner ring, a suitable internal clearance is achieved by selecting the appropriate tolerance class for the raceway diameter. Recommended values are listed in **table 2**. The recommendations apply, provided the housing bore is not tighter than a K7 tolerance class.

Misalignment

The ends of the needle rollers are relieved slightly to modify the line contact between the raceways and rollers. This provides favourable load distribution in the bearing and minimizes damaging edge stresses. It also enables needle roller bearings with machined rings to accommodate a small amount of misalignment, approximately 1 min of arc between the shaft and housing.

The detrimental effects of misalignment increase with increasing bearing width and load. For additional information, contact the SKF application engineering service.

Table 1

ISO tolerance class

Nominal inside diameter F_w		F6 tolerance class	
over	incl.	high	low
mm		µm	
–	3	+12	+6
3	6	+18	+10
6	10	+22	+13
10	18	+27	+16
18	30	+33	+20
30	50	+41	+25
50	80	+49	+30
80	120	+58	+36
120	180	+68	+43
180	250	+79	+50
250	315	+88	+56
315	400	+98	+62
400	500	+108	+68

Table 2

Shaft tolerance classes for needle roller bearings without an inner ring

Nominal inside diameter F_w		Shaft tolerance classes for shaft raceways to give operational clearance		
over	incl.	lower side	medium	higher side
mm		–		
–	65	k5	h5	g6
65	80	k5	h5	f6
80	160	k5	g5	f6
160	180	k5	g5	e6
180	200	j5	g5	e6
200	250	j5	f6	e6
250	315	h5	f6	e6
315	400	g5	f6	d6

Fig. 15

Machined steel cage

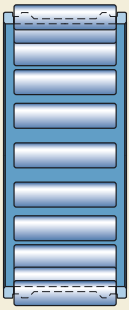


Fig. 16

Sheet steel cage

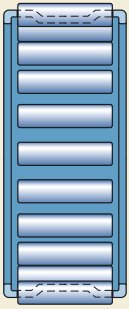
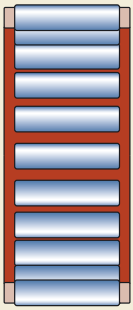


Fig. 17

Polyamide 66 cage



Cages

Depending on their size, SKF needle roller bearings with machined rings are fitted as standard with a machined steel (→ **fig. 15**) or sheet steel cage (→ **fig. 16**), no designation suffix. A number of bearings are fitted as standard with an injection moulded cage of glass fibre reinforced polyamide 66 (→ **fig. 17**), designation suffix TN.

Note

Needle roller bearings with a polyamide 66 cage that are not sealed can be operated at temperatures up to 120 °C. The lubricants generally used for rolling bearings do not have a detrimental effect on cage properties. Exceptions are a few synthetic oils and greases with a synthetic oil base and lubricants containing a high proportion of EP additives when used at high temperatures.

For bearing arrangements that operate at continuously high temperatures or under arduous conditions, SKF recommends using bearings with a steel cage.

For additional information about the temperature resistance and the applicability of cages, refer to the section *Cage materials*, starting on **page 44**.

Shaft and housing tolerances

The shaft tolerances for SKF needle roller bearings with machined rings should be in accordance with the fits that are listed in **table 3**.

When needle roller bearings with an inner ring are used under conditions of point load and mounted with a loose fit, the inner ring seat should be machined to h6 or g6 tolerance class.

When the load rotates, the inner rings should have an interference fit. Sufficient interference can be obtained if the recommended shaft tolerance classes (→ **table 3**) are applied.

For information about housing tolerances for needle roller bearings with an inner ring, refer to the SKF *General Catalogue*, section *Application of bearings/Recommended fits*.

Table 3

Fits for needle roller bearings with machined rings with an inner ring on solid steel shafts

Conditions	Shaft diameter	Tolerance class
–	mm	–
Rotating inner ring load or direction of load indeterminate		
Light and variable loads ($P \leq 0{,}05\ C$)	≤ 10	k5
	(10) to 25	k6
	(25) to 100	m6
Normal to heavy loads ($P > 0{,}05\ C$)	≤ 25	k5
	(25) to 60	m6
	(60) to 100	n6
	(100) to 400	p6[1)]
Heavy to very heavy loads ($P > 0{,}1\ C$)	(50) to 100	n6[1)]
	(100) to 200	p6[1)]
	> 200	r6[1)]
Stationary inner ring load		
Easy axial displacement of the inner ring on the shaft necessary		g6
Easy axial displacement of the inner ring on the shaft unnecessary		h6

[1)] Bearings with radial internal clearance greater than Normal may be necessary.

Supplementary designations

The designation suffixes used to identify certain features of SKF needle roller bearings are explained in the following.

C2 Bearing internal clearance smaller than Normal

C3 Radial internal clearance greater than Normal

C4 Radial internal clearance greater than C3

CN Bearing internal clearance Normal, only used together with an additional letter (H, L, M, P) that identifies a reduced or displaced clearance range

H.. Needle roller bearing without an inner ring, with reduced inside diameter (under rollers) tolerance, followed by tolerance limits in µm, e.g. H+27+20

IS.. Needle roller bearing with one or more lubricating holes in the inner ring, a figure following indicates the number of holes

ISR.. Needle roller bearing with an annular groove and one or more lubricating holes in the inner ring, a figure following indicates the number of holes

P5 Dimensional and running accuracy to ISO tolerance class 5 specifications (better than P6)

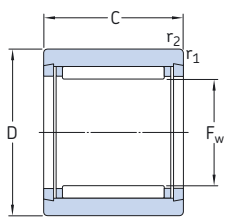
P6 Dimensional and running accuracy to ISO tolerance class 6 specifications (better than Normal)

RS Contact seal of acrylonitrile-butadiene rubber (NRB) with or without sheet steel reinforcement on one side of the bearing

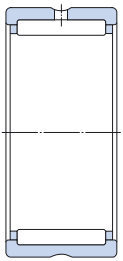
.2RS RS contact seal on both sides of the bearing

TN Injection moulded cage of glass fibre reinforced polyamide 66, rolling element centred

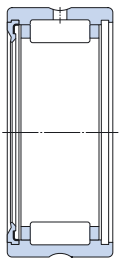
Needle roller bearings with machined rings with flanges, without an inner ring
F_w **5 – 16** mm



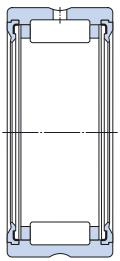
NK ($F_w \leq 10$ mm)



NK ($F_w \geq 12$ mm)
RNA 49
RNA 6901

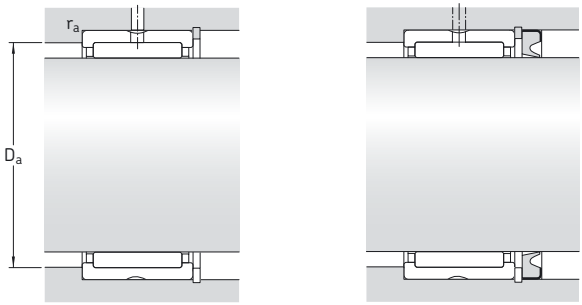


RNA 49.. RS



RNA 49...2RS

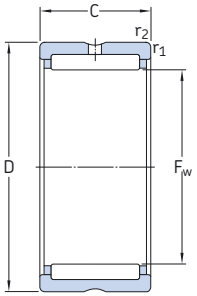
Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation
F_w	D	C	C	C_0	P_u				
mm			kN		kN	r/min		kg	–
5	10	10	2,29	2	0,212	36 000	40 000	0,0031	**NK 5/10 TN**
	10	12	2,92	2,7	0,29	36 000	40 000	0,0037	**NK 5/12 TN**
6	12	10	2,55	2,36	0,25	34 000	38 000	0,0047	**NK 6/10 TN**
	12	12	3,3	3,2	0,345	34 000	38 000	0,0057	**NK 6/12 TN**
7	14	10	2,81	2,75	0,29	32 000	36 000	0,0069	**NK 7/10 TN**
	14	12	3,58	3,75	0,415	32 000	36 000	0,0082	**NK 7/12 TN**
8	15	12	3,8	4,25	0,465	32 000	36 000	0,0087	**NK 8/12 TN**
	15	16	5,01	5,85	0,67	32 000	36 000	0,012	**NK 8/16 TN**
9	16	12	4,4	5,2	0,57	30 000	34 000	0,010	**NK 9/12 TN**
	16	16	5,72	7,2	0,815	30 000	34 000	0,013	**NK 9/16 TN**
10	17	12	4,4	5,4	0,62	28 000	32 000	0,010	**NK 10/12 TN**
	17	16	5,94	8	0,9	28 000	32 000	0,013	**NK 10/16 TN**
12	19	12	6,71	8,15	0,965	26 000	30 000	0,012	**NK 12/12**
	19	16	9,13	12	1,46	26 000	30 000	0,016	**NK 12/16**
14	22	13	8,8	10,4	1,25	26 000	30 000	0,017	**RNA 4900**
	22	13	7,37	8,15	0,95	13 000	12 000	0,016	**RNA 4900 RS**
	22	13	7,37	8,15	0,95	–	12 000	0,016	**RNA 4900.2RS**
	22	16	10,2	12,5	1,53	24 000	28 000	0,021	**NK 14/16**
	22	20	12,8	16,6	2,08	24 000	28 000	0,026	**NK 14/20**
15	23	16	11	14	1,7	24 000	26 000	0,022	**NK 15/16**
	23	20	13,8	18,3	2,28	24 000	26 000	0,027	**NK 15/20**
16	24	13	9,9	12,2	1,46	22 000	26 000	0,017	**RNA 4901**
	24	13	8,09	9,65	1,14	22 000	11 000	0,018	**RNA 4901 RS**
	24	13	8,09	9,65	1,14	–	11 000	0,018	**RNA 4901.2RS**
	24	16	11,7	15,3	1,86	22 000	26 000	0,022	**NK 16/16**
	24	20	14,5	20	2,5	22 000	26 000	0,028	**NK 16/20**
	24	22	16,1	23,2	2,9	22 000	26 000	0,031	**RNA 6901**



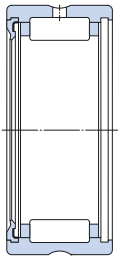
Dimensions		Abutment and fillet dimensions		Appropriate seal[1] Designation
F_w	$r_{1,2}$ min	D_a max	r_a max	
mm		mm		–
5	0,15	8,8	0,1	G 5×10×2 S
	0,15	8,8	0,1	G 5×10×2 S
6	0,15	10,8	0,1	G 6×12×2 S
	0,15	10,8	0,1	G 6×12×2 S
7	0,3	12	0,3	G 7×14×2
	0,3	12	0,3	G 7×14×2
8	0,3	13	0,3	G/SD 8×15×3
	0,3	13	0,3	G/SD 8×15×3
9	0,3	14	0,3	G 9×16×3
	0,3	14	0,3	G 9×16×3
10	0,3	15	0,3	G/SD 10×17×3
	0,3	15	0,3	G/SD 10×17×3
12	0,3	17	0,3	G/SD 12×19×3
	0,3	17	0,3	G/SD 12×19×3
14	0,3	20	0,3	G/SD 14×22×3
	0,3	20	0,3	–
	0,3	20	0,3	–
	0,3	20	0,3	G/SD 14×22×3
	0,3	20	0,3	G/SD 14×22×3
15	0,3	21	0,3	G/SD 15×23×3
	0,3	21	0,3	G/SD 15×23×3
16	0,3	22	0,3	G/SD 16×24×3
	0,3	22	0,3	–
	0,3	22	0,3	–
	0,3	22	0,3	G/SD 16×24×3
	0,3	22	0,3	G/SD 16×24×3
	0,3	22	0,3	G/SD 16×24×3

[1] For additional information, refer to the section *Radial shaft seals with a low cross sectional height*, starting on **page 208**. For additional information about SKF seals, refer to the SKF catalogue *Industrial shaft seals*.

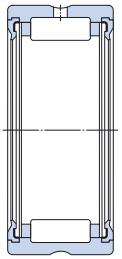
Needle roller bearings with machined rings with flanges, without an inner ring
F_w **17 – 24** mm



NK(S)
RNA 49
RNA 69

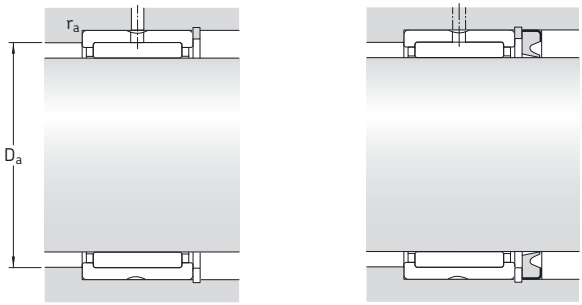


RNA 49.. RS



RNA 49...2RS

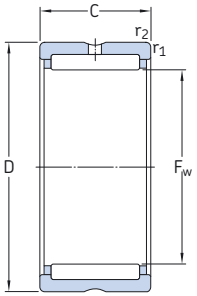
Principal dimensions			**Basic load ratings** dynamic	static	**Fatigue load limit**	**Speed ratings** Reference speed	Limiting speed	**Mass**	**Designation**
F_w	D	C	C	C_0	P_u				
mm			kN		kN	r/min		kg	–
17	25	16	12,1	16,6	2	22 000	26 000	0,024	**NK 17/16**
	25	20	15,1	22	2,75	22 000	26 000	0,030	**NK 17/20**
18	26	16	12,8	17,6	2,16	22 000	24 000	0,025	**NK 18/16**
	26	20	16,1	23,6	3	22 000	24 000	0,031	**NK 18/20**
19	27	16	13,4	19	2,32	20 000	24 000	0,026	**NK 19/16**
	27	20	16,5	25,5	3,2	20 000	24 000	0,032	**NK 19/20**
20	28	13	11,2	15,3	1,83	19 000	22 000	0,022	**RNA 4902**
	28	13	9,13	12	1,4	19 000	9 500	0,022	**RNA 4902 RS**
	28	13	9,13	12	1,4	–	9 500	0,022	**RNA 4902.2RS**
	28	16	13,2	19,3	2,36	19 000	22 000	0,027	**NK 20/16**
	28	20	16,5	25,5	3,2	19 000	22 000	0,034	**NK 20/20**
	32	20	23,3	27	3,45	18 000	20 000	0,049	**NKS 20**
	28	23	17,2	27	3,4	19 000	22 000	0,040	**RNA 6902**
21	29	16	13,8	20,4	2,5	19 000	22 000	0,028	**NK 21/16**
	29	20	17,2	27	3,45	19 000	22 000	0,035	**NK 21/20**
22	30	13	11,4	16,3	1,96	18 000	20 000	0,022	**RNA 4903**
	30	13	9,52	12,9	1,5	18 000	9 000	0,023	**RNA 4903 RS**
	30	13	9,52	12,9	1,5	–	9 000	0,023	**RNA 4903.2RS**
	30	16	14,2	21,6	2,65	18 000	20 000	0,030	**NK 22/16**
	30	20	17,9	29	3,65	18 000	20 000	0,037	**NK 22/20**
	30	23	18,7	30,5	3,9	18 000	20 000	0,042	**RNA 6903**
	35	20	24,6	30	3,9	16 000	19 000	0,062	**NKS 22**
24	32	16	15,4	24,5	3	16 000	19 000	0,032	**NK 24/16**
	32	20	19	32,5	4,05	16 000	19 000	0,040	**NK 24/20**
	37	20	26	33,5	4,25	15 000	17 000	0,066	**NKS 24**



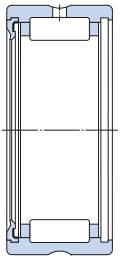
Dimensions		Abutment and fillet dimensions		Appropriate seal[1] Designation
F_w	$r_{1,2}$ min	D_a max	r_a max	
mm		mm		–
17	0,3	23	0,3	G/SD 17×25×3
	0,3	23	0,3	G/SD 17×25×3
18	0,3	24	0,3	G/SD 18×26×4
	0,3	24	0,3	G/SD 18×26×4
19	0,3	25	0,3	G/SD 19×27×4
	0,3	25	0,3	G/SD 19×27×4
20	0,3	26	0,3	G/SD 20×28×4
	0,3	26	0,3	–
	0,3	26	0,3	–
	0,3	26	0,3	G/SD 20×28×4
	0,3	26	0,3	G/SD 20×28×4
	0,6	28	0,6	CR 20×32×7 CRW1 R
	0,3	26	0,3	G/SD 20×28×4
21	0,3	27	0,3	G 21×29×4
	0,3	27	0,3	G 21×29×4
22	0,3	28	0,3	G/SD 22×30×4
	0,3	28	0,3	–
	0,3	28	0,3	–
	0,3	28	0,3	G/SD 22×30×4
	0,3	28	0,3	G/SD 22×30×4
	0,3	28	0,3	G/SD 22×30×4
	0,6	31	0,6	CR 22×35×7 CRW1 R
24	0,3	30	0,3	G/SD 24×32×4
	0,3	30	0,3	G/SD 24×32×4
	0,6	33	0,6	–

[1] For additional information, refer to the section *Radial shaft seals with a low cross sectional height*, starting on **page 208**. For additional information about SKF seals, refer to the SKF catalogue *Industrial shaft seals*.

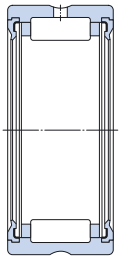
Needle roller bearings with machined rings with flanges, without an inner ring
F_w **25 – 32** mm



NK(S)
RNA 49
RNA 69

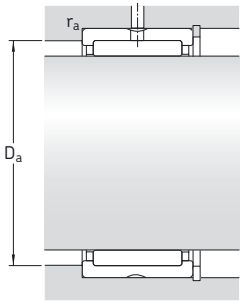


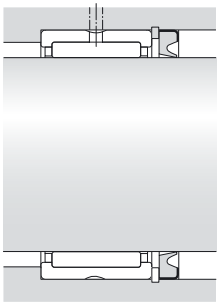
RNA 49.. RS



RNA 49...2RS

Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation
F_w	D	C	C	C_0	P_u				
mm			kN		kN	r/min		kg	–
25	33	16	15,1	24,5	3	16 000	18 000	0,033	**NK 25/16**
	33	20	19	32,5	4,15	16 000	18 000	0,042	**NK 25/20**
	37	17	21,6	28	3,55	15 000	17 000	0,052	**RNA 4904**
	37	17	19,4	22,4	2,75	15 000	7 500	0,056	**RNA 4904 RS**
	37	17	19,4	22,4	2,75	–	7 500	0,056	**RNA 4904.2RS**
	37	30	35,2	53	6,95	15 000	17 000	0,10	**RNA 6904**
	38	20	27,5	36	4,55	15 000	17 000	0,068	**NKS 25**
26	34	16	15,7	26	3,2	15 000	17 000	0,034	**NK 26/16**
	34	20	19,4	34,5	4,3	15 000	17 000	0,042	**NK 26/20**
28	37	20	22	36,5	4,65	14 000	16 000	0,052	**NK 28/20**
	37	30	31,9	60	7,8	14 000	16 000	0,082	**NK 28/30**
	39	17	23,3	32	4,05	14 000	15 000	0,050	**RNA 49/22**
	39	30	36,9	57	7,5	14 000	15 000	0,098	**RNA 69/22**
	42	20	28,6	39	5	13 000	15 000	0,084	**NKS 28**
29	38	20	24,6	42,5	5,2	14 000	15 000	0,050	**NK 29/20 TN**
	38	30	31,9	60	7,8	14 000	15 000	0,084	**NK 29/30**
30	40	20	25,5	44	5,5	13 000	15 000	0,061	**NK 30/20 TN**
	40	30	36,9	72	9	13 000	15 000	0,093	**NK 30/30 TN**
	42	17	24,2	34,5	4,3	13 000	15 000	0,061	**RNA 4905**
	42	17	21,6	27,5	3,35	13 000	6 300	0,060	**RNA 4905 RS**
	42	17	21,6	27,5	3,35	–	6 300	0,060	**RNA 4905.2RS**
	42	30	38	62	8,15	13 000	15 000	0,11	**RNA 6905**
	45	22	31,9	43	5,5	12 000	14 000	0,10	**NKS 30**
32	42	20	26,4	48	6	12 000	14 000	0,064	**NK 32/20 TN**
	42	30	34,1	65,5	8,65	12 000	14 000	0,10	**NK 32/30**
	45	17	25,1	36,5	4,55	12 000	14 000	0,073	**RNA 49/28**
	45	30	39,6	65,5	8,65	12 000	14 000	0,14	**RNA 69/28**
	47	22	34,1	46,5	6	12 000	14 000	0,11	**NKS 32**

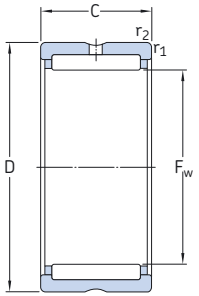




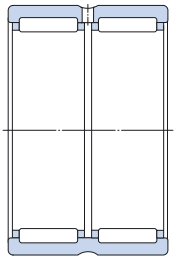
Dimensions		Abutment and fillet dimensions		Appropriate seal[1] Designation
F_w	$r_{1,2}$ min	D_a max	r_a max	
mm		mm		–
25	0,3	31	0,3	G/SD 25×33×4
	0,3	31	0,3	G/SD 25×33×4
	0,3	35	0,3	CR 25×35×7 CRW1 R
	0,3	35	0,3	–
	0,3	35	0,3	–
	0,3	35	0,3	CR 25×35×7 CRW1 R
	0,6	34	0,6	CR 25×38×7 CRW1 R
26	0,3	32	0,3	G/SD 26×34×4
	0,3	32	0,3	G/SD 26×34×4
28	0,3	35	0,3	G 28×37×4
	0,3	35	0,3	G 28×37×4
	0,3	37	0,3	–
	0,3	37	0,3	–
	0,6	38	0,6	CR 28×42×7 CRW1 R
29	0,3	36	0,3	G 29×38×4
	0,3	36	0,3	G 29×38×4
30	0,3	38	0,3	G/SD 30×40×4
	0,3	38	0,3	G/SD 30×40×4
	0,3	40	0,3	CR 30×42×7 CRW1 R
	0,3	40	0,3	–
	0,3	40	0,3	–
	0,3	40	0,3	CR 30×42×7 CRW1 R
	0,6	41	0,6	CR 30×45×8 CRW1 R
32	0,3	40	0,3	G/SD 32×42×4
	0,3	40	0,3	G/SD 32×42×4
	0,3	43	0,3	G 32×45×4
	0,3	43	0,3	G 32×45×4
	0,6	43	0,6	CR 32×47×8 CRW1 R

[1] For additional information, refer to the section *Radial shaft seals with a low cross sectional height*, starting on **page 208**. For additional information about SKF seals, refer to the SKF catalogue *Industrial shaft seals*.

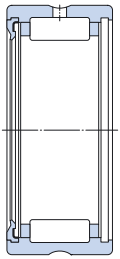
Needle roller bearings with machined rings with flanges, without an inner ring
F_w **35 – 47** mm



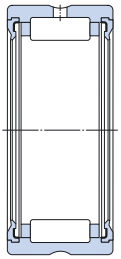
NK(S)
RNA 49
RNA 69 (D ≤ 47 mm)



RNA 69 (D ≥ 52 mm)

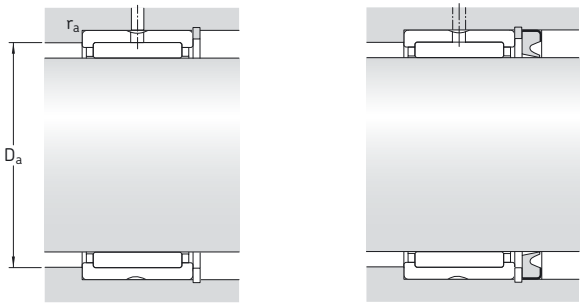


RNA 49.. RS



RNA 49...2RS

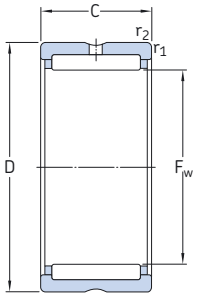
Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation
F_w	D	C	C	C_0	P_u				
mm			kN		kN	r/min		kg	–
35	45	20	27,5	52	6,55	11 000	13 000	0,070	**NK 35/20 TN**
	45	30	40,2	85	10,6	11 000	13 000	0,11	**NK 35/30 TN**
	47	17	25,5	39	4,9	11 000	13 000	0,069	**RNA 4906**
	47	17	23,3	32	3,9	11 000	5 600	0,069	**RNA 4906 RS**
	47	17	23,3	32	3,9	–	5 600	0,069	**RNA 4906.2RS**
	47	30	42,9	75	9,8	11 000	13 000	0,13	**RNA 6906**
	50	22	35,2	50	6,4	11 000	12 000	0,12	**NKS 35**
37	47	20	25,1	46,5	5,85	11 000	12 000	0,077	**NK 37/20**
	47	30	36,9	76,5	10	11 000	12 000	0,11	**NK 37/30**
	52	22	36,9	54	6,95	10 000	12 000	0,12	**NKS 37**
38	48	20	25,5	49	6,2	11 000	12 000	0,079	**NK 38/20**
	48	30	37,4	80	10,4	11 000	12 000	0,12	**NK 38/30**
40	50	20	30,3	61	7,5	10 000	11 000	0,078	**NK 40/20 TN**
	50	30	38	83	10,8	10 000	11 000	0,13	**NK 40/30**
	52	20	30,8	51	6,55	10 000	11 000	0,089	**RNA 49/32**
	52	36	47,3	90	11,2	10 000	11 000	0,16	**RNA 69/32**
	55	22	38	57	7,35	9 500	11 000	0,13	**NKS 40**
42	52	20	27	53	6,7	9 500	11 000	0,086	**NK 42/20**
	52	30	39,1	86,5	11,2	9 500	11 000	0,13	**NK 42/30**
	55	20	31,9	54	6,95	9 500	11 000	0,11	**RNA 4907**
	55	20	27	43	5,4	9 500	4 800	0,11	**RNA 4907 RS**
	55	20	27	43	5,4	–	4 800	0,11	**RNA 4907.2RS**
	55	36	48,4	93	11,8	9 500	11 000	0,19	**RNA 6907**
43	53	20	27,5	55	6,95	9 500	11 000	0,086	**NK 43/20**
	53	30	40,2	90	11,6	9 500	11 000	0,13	**NK 43/30**
	58	22	39,1	61	7,8	9 000	10 000	0,14	**NKS 43**
45	55	20	31,4	67	8,3	9 000	10 000	0,086	**NK 45/20 TN**
	55	30	45,7	108	13,4	9 000	10 000	0,14	**NK 45/30 TN**
	60	22	40,2	64	8,3	8 500	10 000	0,15	**NKS 45**
47	57	20	29,2	61	7,65	8 500	10 000	0,095	**NK 47/20**
	57	30	41,8	98	12,9	8 500	10 000	0,14	**NK 47/30**



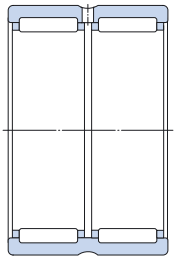
Dimensions		Abutment and fillet dimensions		Appropriate seal[1] Designation
F_w	$r_{1,2}$ min	D_a max	r_a max	
mm		mm		–
35	0,3	43	0,3	G/SD 35×45×4
	0,3	43	0,3	G/SD 35×45×4
	0,3	45	0,3	CR 35×47×7 CRW1 R
	0,3	45	0,3	–
	0,3	45	0,3	–
	0,3	45	0,3	CR 35×47×7 CRW1 R
	0,6	46	0,6	CR 35×50×8 CRW1 R
37	0,3	45	0,3	G/SD 37×47×4
	0,3	45	0,3	G/SD 37×47×4
	0,6	48	0,6	–
38	0,3	46	0,3	G/SD 38×48×4
	0,3	46	0,3	G/SD 38×48×4
40	0,3	48	0,3	G/SD 40×50×4
	0,3	48	0,3	G/SD 40×50×4
	0,6	48	0,6	G/SD 40×52×5
	0,6	48	0,6	G/SD 40×52×5
	0,6	51	0,6	CR 40×55×8 CRW1 R
42	0,3	50	0,3	G/SD 42×52×4
	0,3	50	0,3	G/SD 42×52×4
	0,6	51	0,6	CR 42×55×8 CRW R
	0,6	51	0,6	–
	0,6	51	0,6	–
	0,6	51	0,6	–
43	0,3	51	0,3	G 43×53×4
	0,3	51	0,3	G 43×53×4
	0,6	53	0,6	–
45	0,3	53	0,3	G/SD 45×55×4
	0,3	53	0,3	G/SD 45×55×4
	0,6	56	0,6	CR 45×60×8 CRW1 R
47	0,3	55	0,3	–
	0,3	55	0,3	–

[1] For additional information, refer to the section *Radial shaft seals with a low cross sectional height*, starting on **page 208**. For additional information about SKF seals, refer to the SKF catalogue *Industrial shaft seals*.

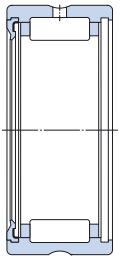
Needle roller bearings with machined rings with flanges, without an inner ring
F_w **48 – 68** mm



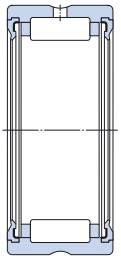
NK(S)
RNA 49



RNA 69

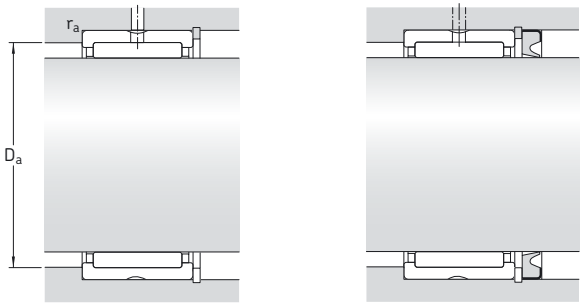


RNA 49.. RS



RNA 49...2RS

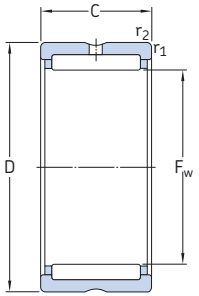
Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation
F_w	D	C	C	C_0	P_u				
mm			kN		kN	r/min		kg	–
48	62	22	42,9	71	9,15	8 000	9 500	0,14	**RNA 4908**
	62	22	36,9	58,5	7,35	8 000	4 000	0,15	**RNA 4908 RS**
	62	22	36,9	58,5	7,35	–	4 000	0,15	**RNA 4908.2RS**
	62	40	67,1	125	16	8 000	9 500	0,26	**RNA 6908**
50	62	25	42,9	93	11,2	8 000	9 000	0,15	**NK 50/25 TN**
	62	35	58,3	137	17	8 000	9 000	0,21	**NK 50/35 TN**
	65	22	42,9	72	9,15	8 000	9 000	0,16	**NKS 50**
52	68	22	45,7	78	10	7 500	8 500	0,18	**RNA 4909**
	68	22	39,1	64	8	7 500	3 800	0,16	**RNA 4909 RS**
	68	22	39,1	64	8	–	3 800	0,16	**RNA 4909.2RS**
	68	40	70,4	137	17,3	7 500	8 500	0,34	**RNA 6909**
55	68	25	40,2	88	11,2	7 500	8 500	0,18	**NK 55/25**
	68	35	52,3	122	16	7 500	8 500	0,25	**NK 55/35**
	72	22	44,6	78	10	7 000	8 000	0,22	**NKS 55**
58	72	22	47,3	85	11	7 000	8 000	0,16	**RNA 4910**
	72	22	40,2	69,5	8,8	7 000	3 400	0,16	**RNA 4910 RS**
	72	22	40,2	69,5	8,8	–	3 400	0,16	**RNA 4910.2RS**
	72	40	73,7	150	19	7 000	8 000	0,31	**RNA 6910**
60	72	25	46,8	110	13,4	6 700	7 500	0,17	**NK 60/25 TN**
	72	35	55	134	17,6	6 700	7 500	0,26	**NK 60/35**
	80	28	62,7	104	13,7	6 300	7 500	0,34	**NKS 60**
63	80	25	57,2	106	13,7	6 300	7 000	0,26	**RNA 4911**
	80	45	89,7	190	24	6 300	7 000	0,47	**RNA 6911**
65	78	25	44	104	13,2	6 300	7 000	0,22	**NK 65/25**
	78	35	58,3	146	19,3	6 300	7 000	0,31	**NK 65/35**
	85	28	66	114	15	6 000	6 700	0,36	**NKS 65**
68	82	25	44	95	12	6 000	6 700	0,24	**NK 68/25**
	82	35	60,5	146	19	6 000	6 700	0,34	**NK 68/35**
	85	25	60,5	114	14,6	6 000	6 700	0,28	**RNA 4912**
	85	45	93,5	204	26	6 000	6 700	0,49	**RNA 6912**



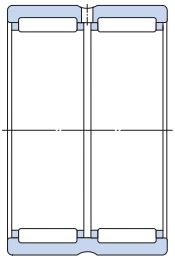
Dimensions		Abutment and fillet dimensions		Appropriate seal[1] Designation
F_w	$r_{1,2}$ min	D_a max	r_a max	
mm		mm		–
48	0,6	58	0,6	CR 48×62×8 CRW1 R
	0,6	58	0,6	–
	0,6	58	0,6	–
	0,6	58	0,6	–
50	0,6	58	0,6	G/SD 50×62×5
	0,6	58	0,6	G/SD 50×62×5
	1	60	1	CR 50×65×8 CRW1 R
52	0,6	64	0,6	CR 52×68×8 CRW1 R
	0,6	64	0,6	–
	0,6	64	0,6	–
	0,6	64	0,6	–
55	0,6	64	0,6	–
	0,6	64	0,6	–
	1	67	1	CR 55×72×8 CRW1 R
58	0,6	68	0,6	CR 58×72×8 CRW1 R
	0,6	68	0,6	–
	0,6	68	0,6	–
	0,6	68	0,6	–
60	0,6	68	0,6	–
	0,6	68	0,6	–
	1,1	73,5	1	–
63	1	75	1	CR 63×80×8 CRW1 R
	1	75	1	–
65	0,6	74	0,6	–
	0,6	74	0,6	–
	1,1	78,5	1	CR 65×85×8 CRW1 R
68	0,6	78	0,6	–
	0,6	78	0,6	–
	1	80	1	CR 68×85×8 CRW1 R
	1	80	1	–

[1] For additional information, refer to the section *Radial shaft seals with a low cross sectional height*, starting on **page 208**. For additional information about SKF seals, refer to the SKF catalogue *Industrial shaft seals*.

Needle roller bearings with machined rings with flanges, without an inner ring
F_w **70 – 100** mm

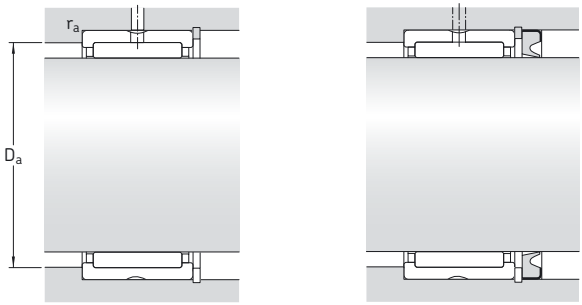


NK(S)
RNA 49



RNA 69

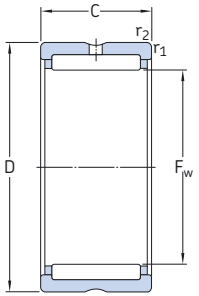
Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation
F_w	D	C	C	C_0	P_u				
mm			kN		kN	r/min		kg	–
70	85	25	44,6	98	12,5	6 000	6 700	0,26	**NK 70/25**
	85	35	61,6	150	19,6	6 000	6 700	0,37	**NK 70/35**
	90	28	68,2	120	15,6	5 600	6 300	0,38	**NKS 70**
72	90	25	61,6	120	15,3	5 600	6 300	0,31	**RNA 4913**
	90	45	95,2	212	27	5 600	6 300	0,58	**RNA 6913**
73	90	25	52,8	106	13,7	5 600	6 300	0,30	**NK 73/25**
	90	35	73,7	163	21,6	5 600	6 300	0,43	**NK 73/35**
75	92	25	53,9	110	14	5 300	6 000	0,32	**NK 75/25**
	92	35	74,8	170	22	5 300	6 000	0,45	**NK 75/35**
	95	28	70,4	132	17	5 300	6 000	0,40	**NKS 75**
80	95	25	56,1	127	16	5 000	5 600	0,30	**NK 80/25**
	95	35	76,5	190	25	5 000	5 600	0,43	**NK 80/35**
	100	30	84,2	163	21,6	5 000	5 600	0,46	**RNA 4914**
	100	54	128	285	37,5	5 000	5 600	0,86	**RNA 6914**
85	105	25	69,3	132	17	4 800	5 300	0,43	**NK 85/25**
	105	30	84,2	170	22,4	4 800	5 300	0,49	**RNA 4915**
	105	35	96,8	200	27	4 800	5 300	0,60	**NK 85/35**
	105	54	130	290	38	4 800	5 300	0,94	**RNA 6915**
90	110	25	72,1	140	18,3	4 500	5 000	0,45	**NK 90/25**
	110	30	88	183	24	4 500	5 000	0,52	**RNA 4916**
	110	35	101	216	29	4 500	5 000	0,63	**NK 90/35**
	110	54	134	315	41,5	4 500	5 000	0,99	**RNA 6916**
95	115	26	73,7	146	19	4 300	4 800	0,49	**NK 95/26**
	115	36	105	232	30,5	4 300	4 800	0,68	**NK 95/36**
100	120	26	76,5	156	19,6	4 000	4 500	0,52	**NK 100/26**
	120	35	108	250	32	4 000	4 500	0,66	**RNA 4917**
	120	36	108	250	32	4 000	4 500	0,72	**NK 100/36**
	120	63	165	425	54	4 000	4 500	1,20	**RNA 6917**



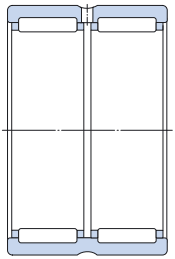
Dimensions		Abutment and fillet dimensions		Appropriate seal[1] Designation
F_w	$r_{1,2}$ min	D_a max	r_a max	
mm		mm		–
70	0,6	81	0,6	CR 70×85×8 CRW1 R
	0,6	81	0,6	CR 70×85×8 CRW1 R
	1,1	83,5	1	CR 70×95×10 CRW1 R
72	1	85	1	CR 72×90×10 CRSH1 R
	1	85	1	–
73	1	85	1	–
	1	85	1	–
75	1	87	1	–
	1	87	1	–
	1,1	88,5	1	CR 75×95×10 CRW1 R
80	1	90	1	–
	1	90	1	–
	1	95	1	CR 80×100×10 CRW1 R
	1	95	1	–
85	1	100	1	CR 85×105×10 CRW1 R
	1	100	1	CR 85×105×10 CRW1 R
	1	100	1	CR 85×105×10 CRW1 R
	1	100	1	–
90	1	105	1	CR 90×110×12 CRW1 R
	1	105	1	CR 90×110×12 CRW1 R
	1	105	1	CR 90×110×12 CRW1 R
	1	105	1	–
95	1	110	1	CR 95×115×12 CRW1 R
	1	110	1	CR 95×115×12 CRW1 R
100	1	115	1	CR 100×120×12 CRW1 R
	1,1	113,5	1	CR 100×120×12 CRW1 R
	1	115	1	CR 100×120×12 CRW1 R
	1,1	113,5	1	–

[1] For additional information, refer to the section *Radial shaft seals with a low cross sectional height*, starting on **page 208**. For additional information about SKF seals, refer to the SKF catalogue *Industrial shaft seals*.

Needle roller bearings with machined rings with flanges, without an inner ring
F_w **105 – 210** mm

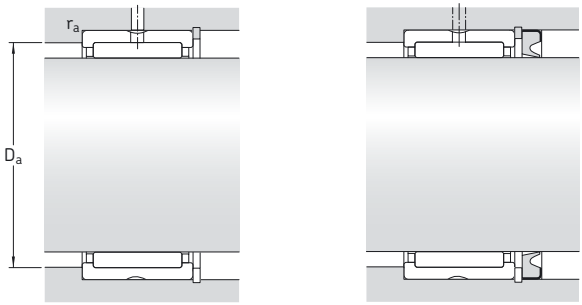


NK
RNA 48
RNA 49



RNA 69

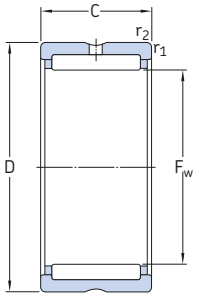
Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation
F_w	D	C	C	C_0	P_u				
mm			kN		kN	r/min		kg	–
105	125	26	78,1	166	20,8	3 800	4 300	0,54	**NK 105/26**
	125	35	112	265	33,5	3 800	4 300	0,75	**RNA 4918**
	125	36	112	265	33,5	3 800	4 300	0,71	**NK 105/36**
	125	63	172	450	57	3 800	4 300	1,35	**RNA 6918**
110	130	30	96,8	220	27,5	3 600	4 000	0,65	**NK 110/30**
	130	35	114	270	34	3 600	4 000	0,72	**RNA 4919**
	130	40	123	305	38	3 600	4 000	0,83	**NK 110/40**
	130	63	172	465	57	3 600	4 000	1,45	**RNA 6919**
115	140	40	125	280	34,5	3 400	4 000	1,15	**RNA 4920**
120	140	30	93,5	232	27,5	3 400	3 800	0,67	**RNA 4822**
125	150	40	130	300	36,5	3 200	3 600	1,25	**RNA 4922**
130	150	30	99	255	30	3 200	3 600	0,73	**RNA 4824**
135	165	45	176	405	47,5	3 000	3 400	1,85	**RNA 4924**
145	165	35	119	325	37,5	2 800	3 200	0,99	**RNA 4826**
150	180	50	198	480	55	2 600	3 000	2,20	**RNA 4926**
155	175	35	121	345	38	2 600	3 000	1,05	**RNA 4828**
160	190	50	205	510	58,5	2 400	2 800	2,35	**RNA 4928**
165	190	40	147	415	46,5	2 400	2 800	1,60	**RNA 4830**
175	200	40	157	450	50	2 200	2 600	1,70	**RNA 4832**
185	215	45	179	520	57	2 200	2 400	2,55	**RNA 4834**
195	225	45	190	570	60	2 000	2 400	2,70	**RNA 4836**
210	240	50	220	710	73,5	1 900	2 200	3,20	**RNA 4838**



Dimensions		Abutment and fillet dimensions		Appropriate seal[1] Designation
F_w	$r_{1,2}$ min	D_a max	r_a max	
mm		mm		–
105	1	120	1	–
	1,1	118,5	1	–
	1	120	1	–
	1,1	118,5	1	–
110	1,1	123,5	1	CR 110×130×12 CRW1 R
	1,1	123,5	1	–
	1,1	123,5	1	CR 110×130×12 CRW1 R
	1,1	123,5	1	–
115	1,1	133,5	1	CR 115×140×12 CRW1 R
120	1	135	1	CR 120×140×13 HMS4 R
125	1,1	143,5	1	CR 125×150×12 CRW1 R
130	1	145	1	–
135	1,1	158,5	1	–
145	1,1	158,5	1	CR 145×165×13 CRSH1 R
150	1,5	1172	1,5	CR 150×180×12 HMS4 R
155	1,1	168,5	1	–
160	1,5	182	1,5	CR 160×190×15 CRW1 V
165	1,1	183,5	1	–
175	1,1	193,5	1	–
185	1,1	208,5	1	–
195	1,1	218,5	1	–
210	1,5	232	1,5	–

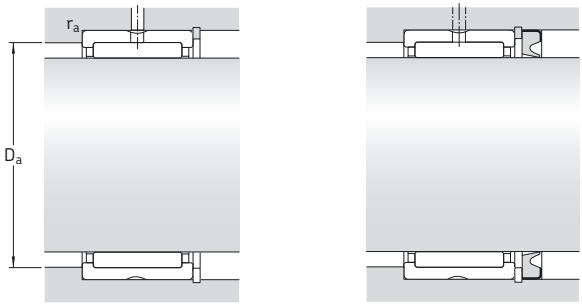
[1] For additional information, refer to the section *Radial shaft seals with a low cross sectional height*, starting on **page 208**. For additional information about SKF seals, refer to the SKF catalogue *Industrial shaft seals*.

Needle roller bearings with machined rings with flanges, without an inner ring
F_w **220 – 415** mm



RNA 48

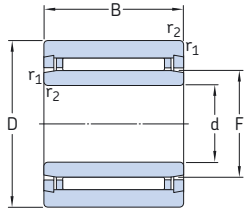
Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation
F_w	D	C	C	C_0	P_u				
mm			kN		kN	r/min		kg	–
220	250	50	224	735	75	1 800	2 000	3,35	**RNA 4840**
240	270	50	238	815	81,5	1 700	1 900	3,60	**RNA 4844**
265	300	60	347	1 120	108	1 500	1 700	5,40	**RNA 4848**
285	320	60	358	1 200	114	1 400	1 500	5,80	**RNA 4852**
305	350	69	429	1 320	127	1 300	1 400	9,30	**RNA 4856**
330	380	80	594	1 800	170	1 100	1 300	12,5	**RNA 4860**
350	400	80	605	1 900	176	1 100	1 200	13,5	**RNA 4864**
370	420	80	616	1960	180	1 000	1 200	14,0	**RNA 4868**
390	440	80	627	2040	186	950	1 100	15,0	**RNA 4872**
415	480	100	968	3000	265	900	1 000	26,0	**RNA 4876**



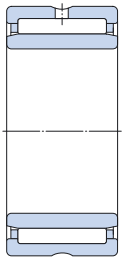
Dimensions		Abutment and fillet dimensions		Appropriate seal[1] Designation
F_w	$r_{1,2}$ min	D_a max	r_a max	
mm		mm		–
220	1,5	242	1,5	CR 220×250×15 HMS4 R
240	1,5	262	1,5	CR 240×270×16 HDS1 R
265	2	291	2	–
285	2	311	2	–
305	2	341	2	–
330	2,1	369	2	–
350	2,1	389	2	CR 350×400×17 HDS1 R
370	2,1	409	2	CR 370×420×25 HDS1 R
390	2,1	429	2	–
415	2,1	469	2	–

[1] For additional information, refer to the section *Radial shaft seals with a low cross sectional height*, starting on **page 208**. For additional information about SKF seals, refer to the SKF catalogue *Industrial shaft seals*.

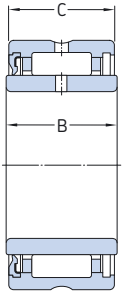
Needle roller bearings with machined rings with flanges, with an inner ring
d **5 – 17** mm



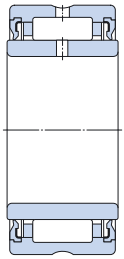
NKI (d ≤ 7 mm)



NKI(S) (d ≥ 9 mm)
NA 49
NA 69

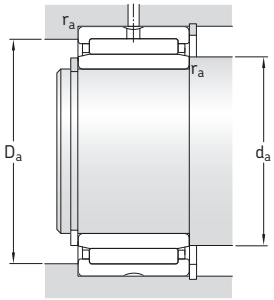


NA 49.. RS



NA 49...2RS

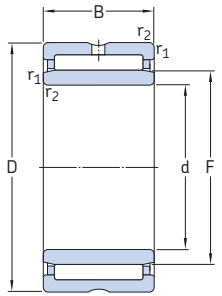
Principal dimensions				Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation
d	D	B	C	C	C_0	P_u				
mm				kN		kN	r/min		kg	–
5	15	12	–	3,8	4,25	0,465	32 000	36 000	0,012	**NKI 5/12 TN**
	15	16	–	5,01	5,85	0,67	32 000	36 000	0,015	**NKI 5/16 TN**
6	16	12	–	4,4	5,2	0,57	30 000	34 000	0,014	**NKI 6/12 TN**
	16	16	–	5,72	7,2	0,815	30 000	34 000	0,017	**NKI 6/16 TN**
7	17	12	–	4,57	5,7	0,63	28 000	32 000	0,014	**NKI 7/12 TN**
	17	16	–	5,94	8	0,9	28 000	32 000	0,018	**NKI 7/16 TN**
9	19	12	–	6,71	8,15	0,965	26 000	30 000	0,017	**NKI 9/12**
	19	16	–	9,13	12	1,46	26 000	30 000	0,022	**NKI 9/16**
10	22	13	–	8,8	10,4	1,25	24 000	28 000	0,023	**NA 4900**
	22	14	13	7,37	8,15	0,95	13 000	12 000	0,025	**NA 4900 RS**
	22	14	13	7,37	8,15	0,95	–	12 000	0,025	**NA 4900.2RS**
	22	16	–	10,2	12,5	1,53	24 000	28 000	0,029	**NKI 10/16**
	22	20	–	12,8	16,6	2,08	24 000	28 000	0,037	**NKI 10/20**
12	24	13	–	9,9	12,2	1,46	22 000	26 000	0,026	**NA 4901**
	24	14	13	8,09	9,65	1,14	22 000	11 000	0,028	**NA 4901 RS**
	24	14	13	8,09	9,65	1,14	–	11 000	0,028	**NA 4901.2RS**
	24	16	–	11,7	15,3	1,86	22 000	26 000	0,033	**NKI 12/16**
	24	20	–	14,5	20	2,5	22 000	26 000	0,042	**NKI 12/20**
	24	22	–	16,1	23,2	2,9	22 000	26 000	0,046	**NA 6901**
15	27	16	–	13,4	19	2,32	20 000	24 000	0,039	**NKI 15/16**
	27	20	–	16,5	25,5	3,2	20 000	24 000	0,049	**NKI 15/20**
	28	13	–	11,2	15,3	1,83	19 000	22 000	0,034	**NA 4902**
	28	14	13	9,13	12	1,4	19 000	9 500	0,037	**NA 4902 RS**
	28	14	13	9,13	12	1,4	–	9 500	0,037	**NA 4902.2RS**
	28	23	–	17,2	27	3,4	19 000	22 000	0,064	**NA 6902**
	35	20	–	24,6	30	3,9	16 000	19 000	0,092	**NKIS 15**
17	29	16	–	13,8	20,4	2,5	19 000	22 000	0,042	**NKI 17/16**
	29	20	–	17,2	27	3,45	19 000	22 000	0,053	**NKI 17/20**
	30	13	–	11,4	16,3	1,96	18 000	20 000	0,037	**NA 4903**
	30	14	13	9,52	12,9	1,5	18 000	9 000	0,040	**NA 4903 RS**
	30	14	13	9,52	12,9	1,5	–	9 000	0,040	**NA 4903.2RS**
	30	23	–	18,7	30,5	3,9	18 000	20 000	0,072	**NA 6903**
	37	20	–	26	33,5	4,25	15 000	17 000	0,098	**NKIS 17**



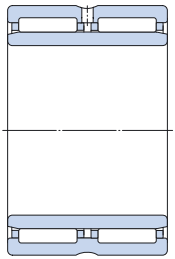
Dimensions				Abutment and fillet dimensions		
d	F	$r_{1,2}$ min	s[1]	d_a min	D_a max	r_a max
mm				mm		
5	8	0,3	1,5	7	13	0,3
	8	0,3	2	7	13	0,3
6	9	0,3	1,5	8	14	0,3
	9	0,3	2	8	14	0,3
7	10	0,3	1,5	9	15	0,3
	10	0,3	2	9	15	0,3
9	12	0,3	1,5	11	17	0,3
	12	0,3	2	11	17	0,3
10	14	0,3	0,5	12	20	0,3
	14	0,3	0,5	12	20	0,3
	14	0,3	0,5	12	20	0,3
	14	0,3	0,5	12	20	0,3
	14	0,3	0,5	12	20	0,3
12	16	0,3	0,5	14	22	0,3
	16	0,3	0,5	14	22	0,3
	16	0,3	0,5	14	22	0,3
	16	0,3	0,5	14	22	0,3
	16	0,3	0,5	14	22	0,3
	16	0,3	1	14	22	0,3
15	19	0,3	0,5	17	25	0,3
	19	0,3	0,5	17	25	0,3
	20	0,3	0,5	17	26	0,3
	20	0,3	0,5	17	26	0,3
	20	0,3	0,5	17	26	0,3
	20	0,3	1	17	26	0,3
	22	0,6	0,5	19	31	0,6
17	21	0,3	0,5	19	27	0,3
	21	0,3	0,5	19	27	0,3
	22	0,3	0,5	19	28	0,3
	22	0,3	0,5	19	28	0,3
	22	0,3	0,5	19	28	0,3
	22	0,3	1	19	28	0,3
	24	0,6	0,5	21	33	0,6

[1] Permissible axial displacement from normal position of one bearing ring relative to the other

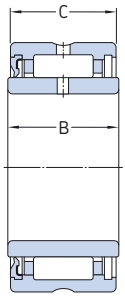
Needle roller bearings with machined rings with flanges, with an inner ring
d **20 – 32** mm



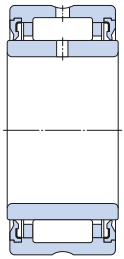
NKI(S)
NA 49
NA 69 (D < 47 mm)



NA 69 (D ≥ 52 mm)

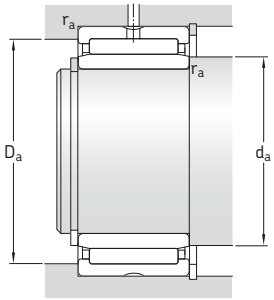


NA 49.. RS



NA 49...2RS

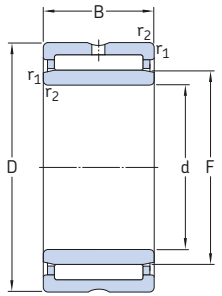
Principal dimensions				Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation
d	D	B	C	C	C_0	P_u				
mm				kN		kN	r/min		kg	–
20	32	16	–	15,4	24,5	3	16 000	19 000	0,049	**NKI 20/16**
	32	20	–	19	32,5	4,05	16 000	19 000	0,061	**NKI 20/20**
	37	17	–	21,6	28	3,55	15 000	17 000	0,075	**NA 4904**
	37	18	17	19,4	22,4	2,75	15 000	7 500	0,080	**NA 4904 RS**
	37	18	17	19,4	22,4	2,75	–	7 500	0,080	**NA 4904.2RS**
	37	30	–	35,2	53	6,95	15 000	17 000	0,14	**NA 6904**
	42	20	–	28,6	39	5	13 000	15 000	0,13	**NKIS 20**
22	34	16	–	15,7	26	3,2	15 000	17 000	0,052	**NKI 22/16**
	34	20	–	19,4	34,5	4,3	15 000	17 000	0,065	**NKI 22/20**
	39	17	–	23,3	32	4,05	14 000	15 000	0,080	**NA 49/22**
	39	30	–	36,9	57	7,5	14 000	15 000	0,15	**NA 69/22**
25	38	20	–	24,6	42,5	5,2	14 000	15 000	0,076	**NKI 25/20 TN**
	38	30	–	31,9	60	7,8	14 000	15 000	0,12	**NKI 25/30**
	42	17	–	24,2	34,5	4,3	13 000	15 000	0,088	**NA 4905**
	42	18	17	21,6	27,5	3,35	13 000	6 300	0,090	**NA 4905 RS**
	42	18	17	21,6	27,5	3,35	–	6 300	0,090	**NA 4905.2RS**
	42	30	–	38	62	8,15	13 000	15 000	0,16	**NA 6905**
	47	22	–	34,1	46,5	6	12 000	13 000	0,16	**NKIS 25**
28	42	20	–	26,4	48	6	12 000	14 000	0,093	**NKI 28/20 TN**
	42	30	–	34,1	65,5	8,65	12 000	14 000	0,15	**NKI 28/30**
	45	17	–	25,1	36,5	4,55	12 000	14 000	0,098	**NA 49/28**
	45	30	–	39,6	65,5	8,65	12 000	14 000	0,18	**NA 69/28**
30	45	20	–	27,5	52	6,55	11 000	13 000	0,11	**NKI 30/20 TN**
	45	30	–	40,2	85	10,6	11 000	13 000	0,17	**NKI 30/30 TN**
	47	17	–	25,5	39	4,9	11 000	13 000	0,10	**NA 4906**
	47	18	17	23,3	32	3,9	11 000	5 600	0,10	**NA 4906 RS**
	47	18	17	23,3	32	3,9	–	5 600	0,10	**NA 4906.2RS**
	47	30	–	42,9	75	9,8	11 000	13 000	0,19	**NA 6906**
	52	22	–	36	54	6,95	10 000	12 000	0,18	**NKIS 30**
32	47	20	–	25,1	46,5	5,85	11 000	12 000	0,12	**NKI 32/20**
	47	30	–	36,9	76,5	10	11 000	12 000	0,18	**NKI 32/30**
	52	20	–	30,8	51	6,55	10 000	11 000	0,16	**NA 49/32**
	52	36	–	47,3	90	11,2	10 000	11 000	0,29	**NA 69/32**



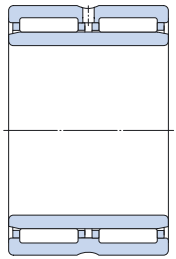
Dimensions				Abutment and fillet dimensions		
d	F	$r_{1,2}$ min	s[1)]	d_a min	D_a max	r_a max
mm				mm		
20	24	0,3	0,5	22	30	0,3
	24	0,3	0,5	22	30	0,3
	25	0,3	0,8	22	35	0,3
	25	0,3	0,5	22	35	0,3
	25	0,3	0,5	22	35	0,3
	25	0,3	1	22	35	0,3
	28	0,6	0,5	24	38	0,6
22	26	0,3	0,5	24	32	0,3
	26	0,3	0,5	24	32	0,3
	28	0,3	0,8	24	37	0,3
	28	0,3	0,5	24	37	0,3
25	29	0,3	1	27	36	0,3
	29	0,3	1,5	27	36	0,3
	30	0,3	0,8	27	40	0,3
	30	0,3	0,5	27	40	0,3
	30	0,3	0,5	27	40	0,3
	30	0,3	1	27	40	0,3
	32	0,6	1	29	43	0,6
28	32	0,3	1	30	40	0,3
	32	0,3	1,5	30	40	0,3
	32	0,3	0,8	30	43	0,3
	32	0,3	1	30	43	0,3
30	35	0,3	0,5	32	43	0,3
	35	0,3	1	32	43	0,3
	35	0,3	0,8	32	45	0,3
	35	0,3	0,5	32	45	0,3
	35	0,3	0,5	32	45	0,3
	35	0,3	1	32	45	0,3
	37	0,6	1	34	48	0,6
32	37	0,3	0,5	34	45	0,3
	37	0,3	1	34	45	0,3
	40	0,6	0,8	36	48	0,6
	40	0,6	0,5	36	48	0,6

[1)] Permissible axial displacement from normal position of one bearing ring in relation to the other

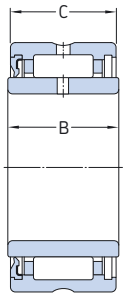
Needle roller bearings with machined rings with flanges, with an inner ring
d **35 – 50** mm



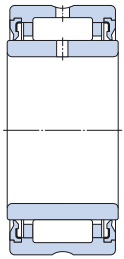
NKI(S)
NA 49



NA 69

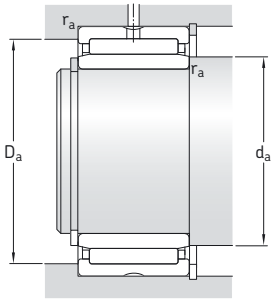


NA 49.. RS



NA 49...2RS

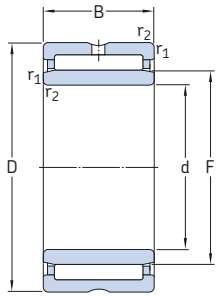
Principal dimensions				Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation
d	D	B	C	C	C_0	P_u				
mm				kN		kN	r/min		kg	–
35	50	20	–	30,3	61	7,5	10 000	11 000	0,13	**NKI 35/20 TN**
	50	30	–	38	83	10,8	10 000	11 000	0,19	**NKI 35/30**
	55	20	–	31,9	54	6,95	9 500	11 000	0,17	**NA 4907**
	55	21	20	27	43	5,4	9 500	5 400	0,18	**NA 4907 RS**
	55	21	20	27	43	5,4	–	5 400	0,18	**NA 4907.2RS**
	55	36	–	48,4	93	11,8	9 500	11 000	0,31	**NA 6907**
	58	22	–	39,1	61	7,8	9 000	10 000	0,22	**NKIS 35**
38	53	20	–	27,5	55	6,95	9 500	11 000	0,14	**NKI 38/20**
	53	30	–	40,2	90	11,6	9 500	11 000	0,21	**NKI 38/30**
40	55	20	–	31,4	67	8,3	9 000	10 000	0,14	**NKI 40/20 TN**
	55	30	–	45,7	108	13,4	9 000	10 000	0,22	**NKI 40/30 TN**
	62	22	–	42,9	71	9,15	8 000	9 500	0,23	**NA 4908**
	62	23	22	36,9	58,5	7,35	8 000	4 000	0,25	**NA 4908 RS**
	62	23	22	36,9	58,5	7,35	–	4 000	0,25	**NA 4908.2RS**
	62	40	–	67,1	125	16	8 000	9 500	0,43	**NA 6908**
	65	22	–	42,9	72	9,15	8 000	9 000	0,28	**NKIS 40**
42	57	20	–	29,2	61	7,65	8 500	10 000	0,15	**NKI 42/20**
	57	30	–	41,8	98	12,9	8 500	10 000	0,22	**NKI 42/30**
45	62	25	–	42,9	93	11,2	8 000	9 000	0,22	**NKI 45/25 TN**
	62	35	–	58,3	137	17	8 000	9 000	0,31	**NKI 45/35 TN**
	68	22	–	45,7	78	10	7 500	8 500	0,27	**NA 4909**
	68	23	22	39,1	64	8	7 500	3 800	0,29	**NA 4909 RS**
	68	23	22	39,1	64	8	–	3 800	0,29	**NA 4909.2RS**
	68	40	–	70,4	137	17,3	7 500	8 500	0,50	**NA 6909**
	72	22	–	44,6	78	10	7 000	8 000	0,34	**NKIS 45**
50	68	25	–	40,2	88	11,2	7 500	8 500	0,27	**NKI 50/25**
	68	35	–	52,3	122	16	7 500	8 500	0,38	**NKI 50/35**
	72	22	–	47,3	85	11	7 000	8 000	0,27	**NA 4910**
	72	23	22	40,2	69,5	8,8	7 000	3 400	0,30	**NA 4910 RS**
	72	23	22	40,2	69,5	8,8	–	3 400	0,30	**NA 4910.2RS**
	72	40	–	73,7	150	19	7 000	8 000	0,52	**NA 6910**
	80	28	–	62,7	104	13,7	6 300	7 500	0,52	**NKIS 50**



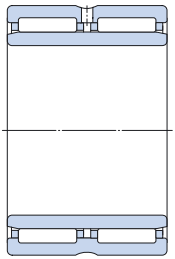
Dimensions				Abutment and fillet dimensions		
d	F	$r_{1,2}$ min	s[1)]	d_a min	D_a max	r_a max
mm				mm		
35	40	0,3	0,5	37	48	0,3
	40	0,3	1	37	48	0,3
	42	0,6	0,8	39	51	0,6
	42	0,6	0,5	39	51	0,6
	42	0,6	0,5	39	51	0,6
	42	0,6	0,5	39	51	0,6
	43	0,6	0,5	39	54	0,6
38	43	0,3	0,5	40	51	0,3
	43	0,3	1	40	51	0,3
40	45	0,3	0,5	42	53	0,3
	45	0,3	1	42	53	0,3
	48	0,6	1	44	58	0,6
	48	0,6	0,5	44	58	0,6
	48	0,6	0,5	44	58	0,6
	48	0,6	0,5	44	58	0,6
	50	1	0,5	45	60	1
42	47	0,3	0,5	44	55	0,3
	47	0,3	1	44	55	0,3
45	50	0,6	1,5	49	58	0,6
	50	0,6	2	49	58	0,6
	52	0,6	1	49	64	0,6
	52	0,6	0,5	49	64	0,6
	52	0,6	0,5	49	64	0,6
	52	0,6	0,5	49	64	0,6
	55	1	0,5	50	67	1
50	55	0,6	1,5	54	64	0,6
	55	0,6	2	54	64	0,6
	58	0,6	1	54	68	0,6
	58	0,6	0,5	54	68	0,6
	58	0,6	0,5	54	68	0,6
	58	0,6	0,5	54	68	0,6
	60	1,1	2	56,5	73,5	1

[1)] Permissible axial displacement from normal position of one bearing ring in relation to the other

Needle roller bearings with machined rings with flanges, with an inner ring
d **55 – 85** mm

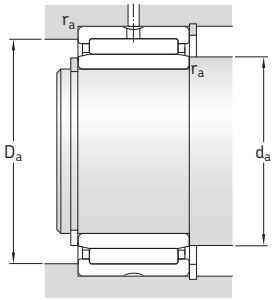


NKI(S)
NA 49



NA 69

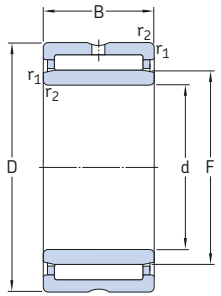
Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation
d	D	B	C	C_0	P_u				
mm			kN		kN	r/min		kg	–
55	72	25	46,8	110	13,4	6 700	7 500	0,26	NKI 55/25 TN
	72	35	55	134	17,6	6 700	7 500	0,38	NKI 55/35
	80	25	57,2	106	13,7	6 300	7 000	0,39	NA 4911
	80	45	89,7	190	24	6 300	7 000	0,78	NA 6911
	85	28	66	114	15	6 000	6 700	0,56	NKIS 55
60	82	25	44	95	12	6 000	6 700	0,39	NKI 60/25
	82	35	60,5	146	19	6 000	6 700	0,55	NKI 60/35
	85	25	60,5	114	14,6	6 000	6 700	0,43	NA 4912
	85	45	93,5	204	26	6 000	6 700	0,81	NA 6912
	90	28	68,2	120	15,6	5 600	6 300	0,56	NKIS 60
65	90	25	61,6	120	15,3	5 600	6 300	0,46	NA 4913
	90	25	52,8	106	13,7	5 600	6 300	0,47	NKI 65/25
	90	35	73,7	163	21,6	5 600	6 300	0,66	NKI 65/35
	90	45	95,2	212	27	5 600	6 300	0,83	NA 6913
	95	28	70,4	132	17	5 300	6 000	0,64	NKIS 65
70	95	25	56,1	127	16	5 000	5 600	0,52	NKI 70/25
	95	35	76,5	190	25	5 000	5 600	0,74	NKI 70/35
	100	30	84,2	163	21,6	5 000	5 600	0,73	NA 4914
	100	54	128	285	37,5	5 000	5 600	1,35	NA 6914
75	105	25	69,3	132	17	4 800	5 300	0,64	NKI 75/25
	105	30	84,2	170	22,4	4 800	5 300	0,78	NA 4915
	105	35	96,8	200	27	4 800	5 300	0,91	NKI 75/35
	105	54	130	290	38	4 800	5 300	1,45	NA 6915
80	110	25	72,1	140	18,3	4 500	5 000	0,68	NKI 80/25
	110	30	88	183	24	4 500	5 000	0,88	NA 4916
	110	35	101	216	29	4 500	5 000	0,96	NKI 80/35
	110	54	134	315	41,5	4 500	5 000	1,50	NA 6916
85	115	26	73,7	146	19	4 300	4 800	0,74	NKI 85/26
	115	36	105	232	30,5	4 300	4 800	1,05	NKI 85/36
	120	35	108	250	32	4 000	4 500	1,25	NA 4917
	120	63	165	425	54	4 000	4 500	2,20	NA 6917



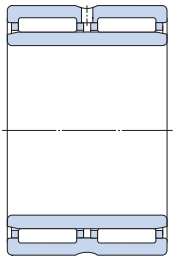
Dimensions				Abutment and fillet dimensions		
d	F	$r_{1,2}$ min	s[1]	d_a min	D_a max	r_a max
mm				mm		
55	60	0,6	1,5	59	68	0,6
	60	0,6	2	59	68	0,6
	63	1	1,5	60	75	1
	63	1	1,5	60	75	1
	65	1,1	2	61,5	78,5	1
60	68	0,6	1	64	78	0,6
	68	0,6	1	64	78	0,6
	68	1	1,5	65	80	1
	68	1	1,5	65	80	1
	70	1,1	2	66,5	83,5	1
65	72	1	1,5	70	85	1
	73	1	1	70	85	1
	73	1	1	70	85	1
	72	1	1,5	70	85	1
	75	1,1	2	71,5	88,5	1
70	80	1	0,8	75	90	1
	80	1	0,8	75	90	1
	80	1	1,5	75	95	1
	80	1	1	75	95	1
75	85	1	1	80	100	1
	85	1	1,5	80	100	1
	85	1	1	80	100	1
	85	1	1	80	100	1
80	90	1	1	85	105	1
	90	1	1,5	85	105	1
	90	1	1	85	105	1
	90	1	1	85	105	1
85	95	1	1,5	90	110	1
	95	1	1,5	90	110	1
	100	1,1	1	91,5	113,5	1
	100	1,1	1	91,5	113,5	1

[1] Permissible axial displacement from normal position of one bearing ring in relation to the other

Needle roller bearings with machined rings with flanges, with an inner ring
d **90 – 220** mm

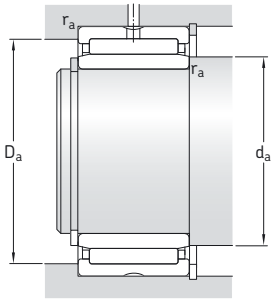


NKI
NA 48
NA 49



NA 69

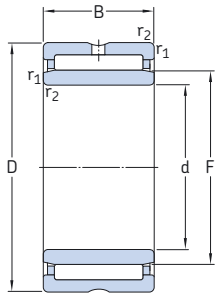
Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation
d	D	B	C	C_0	P_u				
mm			kN		kN	r/min		kg	–
90	120	26	76,5	156	19,6	4 000	4 500	0,78	NKI 90/26
	120	36	108	250	32	4 000	4 500	1,10	NKI 90/36
	125	35	112	265	33,5	3 800	4 300	1,30	NA 4918
	125	63	172	450	57	3 800	4 300	2,30	NA 6918
95	125	26	78,1	166	20,8	3 800	4 300	0,82	NKI 95/26
	125	36	112	265	33,5	3 800	4 300	1,15	NKI 95/36
	130	35	114	270	34	3 600	4 000	1,35	NA 4919
	130	63	172	465	57	3 600	4 000	2,50	NA 6919
100	130	30	96,8	220	27,5	3 600	4 000	0,99	NKI 100/30
	130	40	123	305	38	3 600	4 000	1,35	NKI 100/40
	140	40	125	280	34,5	3 400	4 000	1,90	NA 4920
110	140	30	93,5	232	27,5	3 400	3 800	1,10	NA 4822
	150	40	130	300	36,5	3 200	3 600	2,05	NA 4922
120	150	30	99	255	30	3 200	3 600	1,15	NA 4824
	165	45	176	405	47,5	3 000	3 400	2,85	NA 4924
130	165	35	119	325	37,5	2 800	3 200	1,80	NA 4826
	180	50	198	480	55	2 600	3 000	3,90	NA 4926
140	175	35	121	345	38	2 600	3 000	1,90	NA 4828
	190	50	205	510	58,5	2 400	2 800	4,15	NA 4928
150	190	40	147	415	46,5	2 400	2 800	2,70	NA 4830
160	200	40	157	450	50	2 200	2 600	2,90	NA 4832
170	215	45	179	520	57	2 200	2 400	3,95	NA 4834
180	225	45	190	570	60	2 000	2 400	4,20	NA 4836
190	240	50	220	710	73,5	1 900	2 200	5,60	NA 4838
200	250	50	224	735	75	1 800	2 000	5,85	NA 4840
220	270	50	238	815	81,5	1 700	1 900	6,40	NA 4844



Dimensions				Abutment and fillet dimensions		
d	F	$r_{1,2}$ min	s[1]	d_a min	D_a max	r_a max
mm				mm		
90	100	1	1,5	95	115	1
	100	1	1,5	95	115	1
	105	1,1	1	96,5	118,5	1
	105	1,1	1	96,5	118,5	1
95	105	1	1,5	100	120	1
	105	1	1,5	100	120	1
	110	1,1	1	101,5	123,5	1
	110	1,1	1	101,5	123,5	1
100	110	1,1	1,5	106,5	123,5	1
	110	1,1	2	106,5	123,5	1
	115	1,1	2	106,5	133,5	1
110	120	1	0,8	115	135	1
	125	1,1	2	116,5	143,5	1
120	130	1	0,8	125	145	1
	135	1,1	2	126,5	158,5	1
130	145	1,1	1	136,5	158,5	1
	150	1,5	1,5	138	172	1,5
140	155	1,1	1	146,5	168,5	1
	160	1,5	1,5	148	182	1,5
150	165	1,1	1,5	156,5	183,5	1
160	175	1,1	1,5	166,5	193,5	1
170	185	1,1	1,5	176,5	208,5	1
180	195	1,1	1,5	186,5	218,5	1
190	210	1,5	1,5	198	232	1,5
200	220	1,5	1,5	208	242	1,5
220	240	1,5	1,5	228	262	1,5

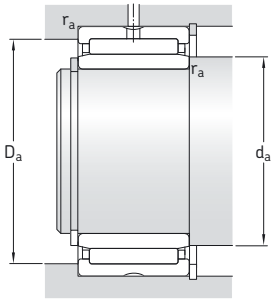
[1] Permissible axial displacement from normal position of one bearing ring in relation to the other

Needle roller bearings with machined rings with flanges, with an inner ring
d **240 – 380** mm



NA 48

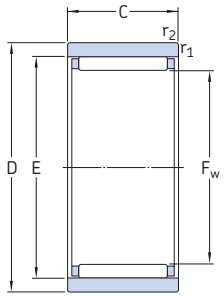
Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation
d	D	B	C	C_0	P_u				
mm			kN		kN	r/min		kg	–
240	300	60	347	1 120	108	1 500	1 700	10,0	NA 4848
260	320	60	358	1 200	114	1 400	1 500	10,5	NA 4852
280	350	69	429	1 320	127	1 300	1 400	15,5	NA 4856
300	380	80	594	1 800	170	1 100	1 300	22,0	NA 4860
320	400	80	605	1 900	176	1 100	1 200	23,0	NA 4864
340	420	80	616	1 960	180	1 000	1 200	24,0	NA 4868
360	440	80	627	2 040	186	950	1 100	25,5	NA 4872
380	480	100	968	3 000	265	900	1 000	42,5	NA 4876



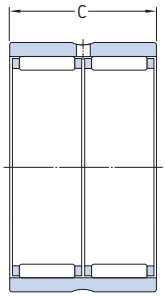
Dimensions				Abutment and fillet dimensions		
d	F	$r_{1,2}$ min	s[1]	d_a min	D_a max	r_a max
mm				mm		
240	265	2	2	249	291	2
260	285	2	2	269	311	2
280	305	2	2,5	289	341	2
300	330	2,1	2	311	369	2
320	350	2,1	2	331	389	2
340	370	2,1	2	351	409	2
360	390	2,1	2	371	429	2
380	415	2,1	2	391	469	2

[1] Permissible axial displacement from normal position of one bearing ring in relation to the other

Needle roller bearings with machined rings without flanges, without an inner ring
F_w **5 – 30** mm



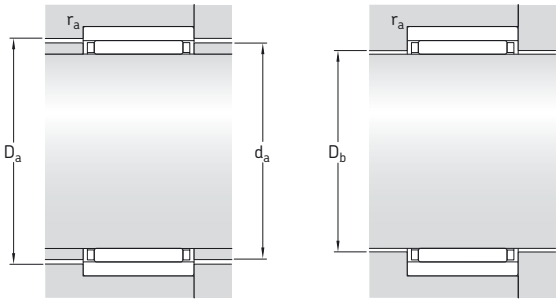
RNAO



RNAO
(double row)

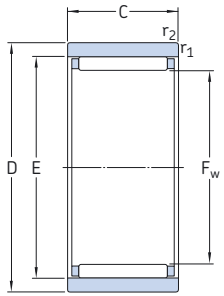
Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation
F_w	D	C	C	C_0	P_u				
mm			kN		kN	r/min		kg	–
5	10	8	2,29	2	0,212	36 000	40 000	0,003	**RNAO 5×10×8 TN**
6	13	8	2,55	2,36	0,25	34 000	38 000	0,006	**RNAO 6×13×8 TN**
7	14	8	2,81	2,75	0,29	32 000	36 000	0,006	**RNAO 7×14×8 TN**
8	15	10	3,8	4,25	0,465	32 000	36 000	0,008	**RNAO 8×15×10 TN**
10	17	10	4,57	5,7	0,63	28 000	32 000	0,010	**RNAO 10×17×10 TN**
12	22	12	9,52	10	1,18	26 000	30 000	0,019	**RNAO 12×22×12 TN**
15	23	13	8,09	10,8	1,25	24 000	28 000	0,020	**RNAO 15×23×13**
16	24	13	8,58	12	1,37	24 000	26 000	0,021	**RNAO 16×24×13**
	28	12	11	12,5	1,5	22 000	26 000	0,032	**RNAO 16×28×12**
17	25	13	10,1	14,6	1,73	22 000	26 000	0,022	**RNAO 17×25×13**
18	30	24	20,9	30	3,6	20 000	24 000	0,069	**RNAO 18×30×24**[1]
20	28	13	9,52	14,6	1,66	20 000	22 000	0,025	**RNAO 20×28×13**
	28	26	16,1	29	3,35	20 000	22 000	0,050	**RNAO 20×28×26**[1]
	32	12	12,8	16,3	1,96	19 000	22 000	0,038	**RNAO 20×32×12**
22	30	13	10,1	16,3	1,86	18 000	20 000	0,027	**RNAO 22×30×13**
	35	16	19,4	25,5	3,05	17 000	19 000	0,059	**RNAO 22×35×16**
25	35	17	14,2	26,5	3,1	16 000	18 000	0,053	**RNAO 25×35×17**
	35	26	18,7	37,5	4,3	16 000	18 000	0,076	**RNAO 25×35×26**[1]
	37	16	20,1	28	3,35	15 000	17 000	0,060	**RNAO 25×37×16**
30	40	17	18,7	34	4,05	13 000	15 000	0,060	**RNAO 30×40×17**
	42	16	22	33,5	4	13 000	15 000	0,059	**RNAO 30×42×16**
	42	32	38	67	8	13 000	15 000	0,14	**RNAO 30×42×32**[1]

[1] Double row, outer ring with a lubrication hole and an annular groove

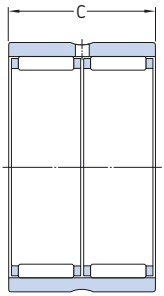


Dimensions			Abutment and fillet dimensions			
F_w	E	$r_{1,2}$ min	d_a	D_a	D_b	r_a max
mm			mm			
5	8	0,15	7,7	8,3	5,3	0,1
6	9	0,3	8,7	9,3	6,3	0,3
7	10	0,3	9,7	10,3	7,3	0,3
8	11	0,3	10,7	11,3	8,3	0,3
10	13	0,3	12,7	13,3	10,3	0,3
12	18	0,3	17,6	18,3	12,3	0,3
15	19	0,3	18,6	19,3	15,4	0,3
16	20 22	0,3 0,3	19,6 21,6	20,3 22,3	16,4 16,4	0,3 0,3
17	21	0,3	20,6	21,3	17,4	0,3
18	24	0,3	23,6	24,5	18,4	0,3
20	24 24 26	0,3 0,3 0,3	23,6 23,6 25,6	24,3 24,3 26,5	20,4 20,4 20,4	0,3 0,3 0,3
22	26 29	0,3 0,3	25,6 28,4	26,3 29,5	22,4 22,4	0,3 0,3
25	30 30 32	0,3 0,3 0,3	29,4 29,4 31,4	30,5 30,5 32,5	25,6 25,6 25,6	0,3 0,3 0,3
30	35 37 37	0,3 0,3 0,3	34,4 36,4 36,4	35,5 37,5 37,5	30,6 30,6 30,6	0,3 0,3 0,3

Needle roller bearings with machined rings without flanges, without an inner ring
F_w **35 – 100** mm



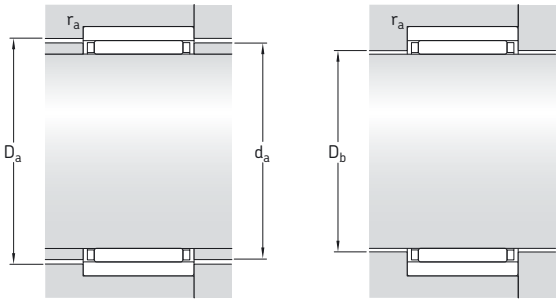
RNAO



RNAO
(double row)

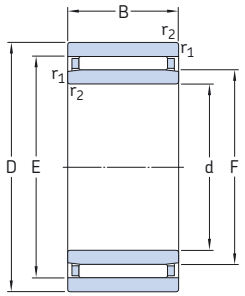
Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation
F_w	D	C	C	C_0	P_u				
mm			kN		kN	r/min		kg	–
35	45	13	15,4	28	3,25	12 000	13 000	0,053	**RNAO 35×45×13**
	45	17	19,8	39	4,65	12 000	13 000	0,069	**RNAO 35×45×17**
	45	26	26,4	56	6,55	12 000	13 000	0,091	**RNAO 35×45×26**[1]
	47	16	23,3	37,5	4,5	11 000	13 000	0,078	**RNAO 35×47×16**
	47	18	26,4	44	5,3	11 000	13 000	0,089	**RNAO 35×47×18**
	47	32	40,2	75	9	11 000	13 000	0,16	**RNAO 35×47×32**[1]
40	50	17	20,5	41,5	5	10 000	12 000	0,074	**RNAO 40×50×17**
	50	34	35,2	83	10	10 000	12 000	0,15	**RNAO 40×50×34**[1]
	55	20	31,4	57	6,95	10 000	11 000	0,15	**RNAO 40×55×20**
	55	40	59,4	118	14,6	10 000	11 000	0,28	**RNAO 40×55×40**[1]
45	55	17	21,6	46,5	5,6	9 000	10 000	0,083	**RNAO 45×55×17**
	62	40	64,4	137	16,6	9 000	10 000	0,38	**RNAO 45×62×40**[1]
50	62	20	25,5	60	7,2	8 500	9 500	0,14	**RNAO 50×62×20**
	65	20	34,1	62	7,65	8 000	9 000	0,17	**RNAO 50×65×20**
	65	40	58,3	125	15,3	8 000	9 000	0,36	**RNAO 50×65×40**[1]
55	68	20	27	67	8,15	7 500	8 500	0,17	**RNAO 55×68×20**
60	78	20	41,8	86,5	10,6	6 700	7 500	0,26	**RNAO 60×78×20**
	78	40	72,1	173	21,2	6 700	7 500	0,44	**RNAO 60×78×40**[1]
65	85	30	53,9	125	15,6	6 300	7 000	0,46	**RNAO 65×85×30**
70	90	30	57,2	137	17	6 000	6 700	0,50	**RNAO 70×90×30**
80	100	30	68,2	176	22	5 000	6 000	0,58	**RNAO 80×100×30**
90	105	26	58,3	150	18,6	4 500	5 300	0,37	**RNAO 90×105×26**
	110	30	64,4	173	21,6	4 500	5 300	0,61	**RNAO 90×110×30**
100	120	30	67,1	190	23,6	4 000	4 800	0,69	**RNAO 100×120×30**

[1] Double row, outer ring with a lubrication hole and an annular groove

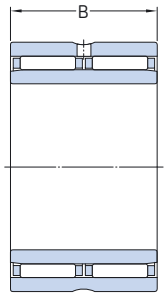


Dimensions			Abutment and fillet dimensions			
F_w	E	$r_{1,2}$ min	d_a	D_a	D_b	r_a max
mm			mm			
35	40	0,3	39,4	40,5	35,6	0,3
	40	0,3	39,4	40,5	35,6	0,3
	40	0,3	39,4	40,5	35,6	0,3
	42	0,3	41,4	42,5	35,8	0,3
	42	0,3	41,4	42,5	35,6	0,3
	42	0,3	41,4	42,5	35,6	0,3
40	45	0,3	44,4	45,5	40,6	0,3
	45	0,3	44,4	45,5	40,6	0,3
	47	0,3	46,2	47,5	40,6	0,3
	48	0,3	47,2	47,5	40,6	0,3
45	50	0,3	49,4	50,5	45,6	0,3
	53	0,3	52,2	53,5	46	0,3
50	55	0,3	54,4	55,8	50,6	0,3
	58	0,3	57,2	58,5	51	0,3
	58	0,3	57,2	58,5	51	0,3
55	60	0,3	59,4	60,8	55,6	0,3
60	68	1	67,2	68,8	61	1
	68	1	67,2	68,8	61	1
65	73	1	72,2	73,8	66	1
70	78	1	77,2	78,8	71	1
80	88	1	87,2	89	81	1
90	98	1	97,2	99	91	1
	98	1	97,2	99	91	1
100	108	1	107,2	109	101	1

Needle roller bearings with machined rings without flanges, with an inner ring
d **6 – 90** mm



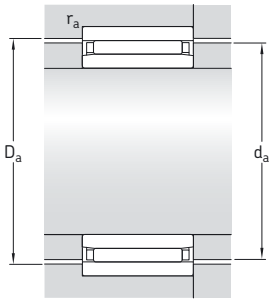
NAO

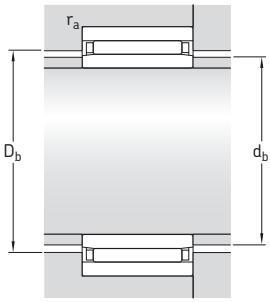


NAO
(double row)

Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation
d	D	B	C	C_0	P_u				
mm			kN		kN	r/min		kg	–
6	17	10	4,57	5,7	0,63	28 000	32 000	0,014	**NAO 6×17×10 TN**[2]
9	22	12	9,52	10	1,18	26 000	28 000	0,024	**NAO 9×22×12 TN**
12	24	13	8,58	12	1,37	24 000	26 000	0,030	**NAO 12×24×13**
	28	12	11	12,5	1,5	22 000	26 000	0,040	**NAO 12×28×12**[2]
15	28	13	9,52	14,6	1,66	20 000	22 000	0,029	**NAO 15×28×13**
	32	12	12,8	16,3	1,96	19 000	22 000	0,050	**NAO 15×32×12**[2]
17	30	13	10,1	16,3	1,86	18 000	20 000	0,042	**NAO 17×30×13**
	35	16	19,4	25,5	3,05	17 000	19 000	0,078	**NAO 17×35×16**
20	35	17	14,2	26,5	3,1	16 000	18 000	0,076	**NAO 20×35×17**
	37	16	20,1	28	3,35	15 000	17 000	0,082	**NAO 20×37×16**
25	40	17	18,7	34	4,05	13 000	15 000	0,088	**NAO 25×40×17**
	42	16	22	33,5	4	13 000	15 000	0,086	**NAO 25×42×16**[2]
	42	32	38	68	8,15	12 000	14 000	0,19	**NAO 25×42×32**[1]
30	45	17	19,8	39	4,65	12 000	13 000	0,10	**NAO 30×45×17**
	45	26	26,4	56	6,55	12 000	13 000	0,16	**NAO 30×45×26**[1]
	47	16	23,3	37,5	4,5	11 000	13 000	0,11	**NAO 30×47×16**
	47	18	26,4	44	5,3	11 000	13 000	0,12	**NAO 30×47×18**
35	50	17	20,5	41,5	5	10 000	12 000	0,11	**NAO 35×50×17**
	55	20	31,4	57	6,95	10 000	11 000	0,19	**NAO 35×55×20**
40	55	17	21,6	46,5	5,6	9 000	10 000	0,13	**NAO 40×55×17**
50	68	20	27	67	8,15	7 500	8 500	0,23	**NAO 50×68×20** [2]
70	100	30	68,2	176	22	5 000	6 000	0,85	**NAO 70×100×30**
80	110	30	64,4	173	21,6	4 500	5 300	0,92	**NAO 80×110×30**
90	120	30	67,1	190	23,6	4 000	4 800	1,05	**NAO 90×120×30**

[1] Double row, outer ring with a lubrication hole and an annular groove
[2] One lubrication hole in the inner ring





Dimensions					Abutment and fillet dimensions				
d	E	F	$r_{1,2}$ min	s[3]	d_a	d_b	D_a	D_b	r_a max
mm					mm			–	
6	13	10	0,3	0,5	12,7	9,7	13,3	10,3	0,3
9	18	12	0,3	0,5	17,6	11,7	18,3	12,3	0,3
12	20	16	0,3	0,5	19,6	15,7	20,3	16,4	0,3
	22	16	0,3	0,5	21,6	15,7	22,3	16,6	0,3
15	24	20	0,3	0,5	23,6	19,5	24,3	20,4	0,3
	26	20	0,3	0,5	25,6	19,5	26,5	20,6	0,3
17	26	22	0,3	0,5	25,6	21,5	26,3	22,4	0,3
	29	22	0,3	0,5	28,4	21,5	29,5	22,6	0,3
20	30	25	0,3	0,5	29,4	24,5	30,5	25,6	0,3
	32	25	0,3	0,5	31,4	24,5	32,5	25,6	0,3
25	35	30	0,3	0,8	34,4	29,5	35,5	30,6	0,3
	37	30	0,3	0,8	36,4	29,5	37,5	30,6	0,3
	37	30	0,3	0,8	36,4	29,5	37,5	30,6	0,3
30	40	35	0,3	0,8	39,4	34,5	40,5	35,6	0,3
	40	35	0,3	0,8	39,4	34,5	40,5	35,6	0,3
	42	35	0,3	0,8	41,4	34,5	42,5	35,6	0,3
	42	35	0,3	0,8	41,4	34,5	42,5	35,6	0,3
35	45	40	0,3	0,8	44,4	39,5	45,5	40,6	0,3
	48	40	0,3	0,8	46,2	39,5	47,5	40,6	0,3
40	50	45	0,3	0,8	49,2	44,5	50,5	45,6	0,3
50	60	55	0,6	1	59,2	54,5	60,8	55,8	0,6
70	88	80	1	1	87,2	79,3	89	81	1
80	98	90	1	1	97,2	89,3	99	91	1
90	108	100	1	1	107,2	99,3	109	101	1

[3] Permissible axial displacement from normal position of one bearing ring relative to the other


SKF

Alignment needle roller bearings

Alignment needle roller bearings have an outer ring with a convex sphered outside surface. Two polymer seating rings with a concave sphered inside surface that is encased in a drawn sheet steel sleeve are fitted over the outer ring, enabling the bearing to align itself. Alignment needle roller bearings are therefore insensitive to static misalignment of the shaft relative to the housing.

SKF supplies alignment needle roller bearings without an inner ring (→ **fig. 1**) and with an inner ring (→ **fig. 2**). Bearings without an inner ring provide the optimum solution for compact arrangements if the shaft can be hardened and ground. In applications where it is not possible or uneconomical to harden and grind the shaft, bearings with an inner ring should be used.

Bearings with an inner ring permit axial displacement of the shaft relative to the housing within certain limits (→ **product table**). If greater axial displacements are anticipated, extended inner rings that are wider than standard inner rings can be used.

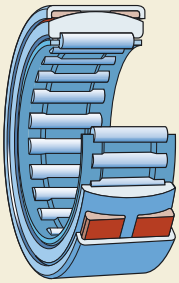
See chapter *Needle roller bearing inner rings*, starting on **page 196**.

The bearings are supplied without grease and not sealed. Depending on the application, they can be grease or oil lubricated.

The ends of the needle rollers are slightly relieved. The resulting modified line contact between the rollers and raceways means that the load distribution in the bearing is improved.

Fig. 1

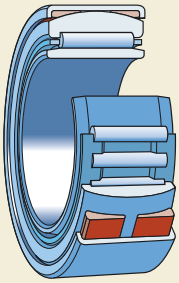
Alignment needle roller bearing without an inner ring



RPNA series

Fig. 2

Alignment needle roller bearing with an inner ring



PNA series

Dimensions

The dimensions of alignment needle roller bearings have not been standardized. However, with the exception of bearings with a 52 mm outside diameter, the inner ring bore and outside diameter are standardized, in accordance with ISO 15:1998, as follows:

- bearings with an outside diameter D ≤ 47 mm follow Diameter Series 0
- bearings with an outside diameter D ≥ 55 mm follow Diameter Series 9

Tolerances

Inner rings, as well as outer rings with a sphered outside surface are manufactured to Normal tolerances in accordance with ISO 492:2002.

The tolerance for the width of the external drawn sheet steel sleeve is ± 0,5 mm.

Internal clearance

SKF alignment needle roller bearings with an inner ring have Normal radial internal clearance as standard. The clearance values are listed in **table 7** on **page 42** and are in accordance with ISO 5753:1991. They are valid for unmounted bearings under zero measuring load.

SKF alignment needle roller bearings without an inner ring have an inside diameter F_w that lies within F6 tolerance class when the bearing is unmounted and the rollers are in contact with the outer ring raceway. If the recommended tolerance classes (→ **table 1**) are applied, the operational clearance will reach a value in the range of C2 to Normal radial internal clearance (→ **table 7**, **page 42**).

Misalignment

Alignment needle roller bearings can compensate static misalignment up to 3° between the shaft and housing. These bearings are unable to accommodate any dynamic misalignment.

Permissible operating temperature

Due to the polymer seating ring material, the permissible operating temperature range for alignment needle roller bearings is –30 to +100 °C.

Table 1

Shaft and housing tolerance classes

Housing material	Tolerance classes Housing bore seat	Shaft inner ring seat	Shaft raceway
Steel, cast iron	N6 N7	k5 j6	h5 h6
Light alloy	R6 R7	k5 j6	h5 h6

Cages

SKF alignment needle roller bearings are fitted with a machined steel (→ **fig. 3**) or a sheet steel cage (→ **fig. 4**), with adequate free space for lubricant.

Shaft and housing tolerances

Alignment needle roller bearings are mounted with an interference fit in the housing bore. Therefore, shoulders or snap rings are not required to locate the bearing axially so the design of the housing bore is simple and can be produced economically.

If the recommended housing bore tolerance classes listed in **table 1** on **page 143** are applied, alignment movements between the outer ring and the sleeve will be possible. These tolerances, together with the tolerance classes recommended for the inner ring shaft seats or for raceways on the shaft, will reach an operational clearance value in the range of C2 to Normal radial internal clearance (→ **table 7**, **page 42**).

Fig. 3

Machined steel cage

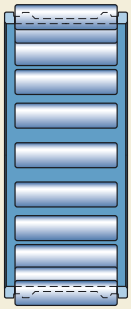
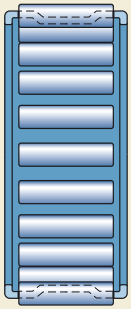


Fig. 4

Sheet steel cage



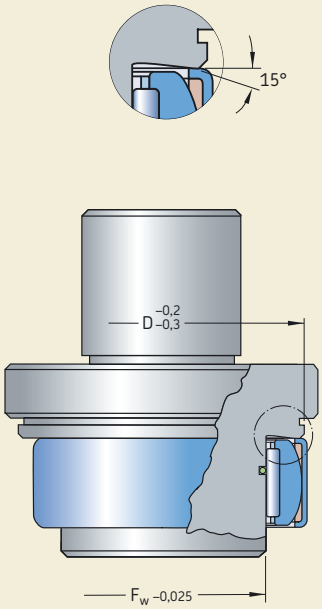
Mounting instructions

When mounting alignment needle roller bearings, the inner ring should be mounted separately. The outer ring and the polymer seating rings with sleeve and needle roller and cage assembly should be mounted with a mounting dolly (**→ fig. 5**). An O-ring provides a simple means of retaining the bearing on the mounting dolly. The stamped side face should abut the flange of the mounting dolly.

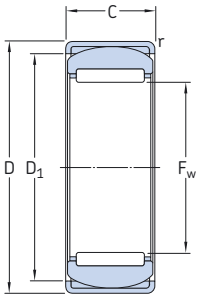
Note
When using grease, the bearing should be lubricated before mounting. Special care should be taken to prevent the sleeve from skewing or tilting when it is being pressed into the housing. Otherwise the rollers and raceways could easily be damaged.

Fig. 5

Mounting dolly

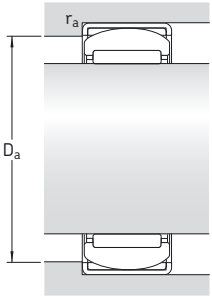


Alignment needle roller bearings without an inner ring
F_w **15 – 45** mm



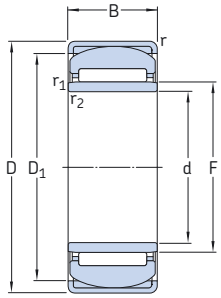
RPNA

Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation
F_w	D	C	C	C_0	P_u				
mm			kN		kN	r/min		kg	–
15	28	12	7,37	9,15	1,08	24 000	28 000	0,032	**RPNA 15/28**
18	32	16	12,8	17,6	2,12	22 000	24 000	0,052	**RPNA 18/32**
20	35	16	13,2	19,3	2,28	19 000	22 000	0,062	**RPNA 20/35**
25	42	20	19	32,5	4	16 000	18 000	0,11	**RPNA 25/42**
28	44	20	22	36,5	4,55	14 000	16 000	0,11	**RPNA 28/44**
30	47	20	22,9	38	4,8	13 000	15 000	0,13	**RPNA 30/47**
35	52	20	24,6	45	5,6	11 000	13 000	0,13	**RPNA 35/52**
40	55	20	26,4	51	6,3	10 000	11 000	0,14	**RPNA 40/55**
45	62	20	27,5	57	7,1	9 000	10 000	0,18	**RPNA 45/62**

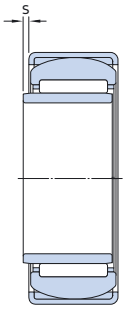


Dimensions			Abutment and fillet dimensions		
F_w	D_1	r min	D_a min	D_a max	r_a max
mm			mm		
15	24,5	1	23,5	24,5	1
18	27	1	26	27	1
20	30,5	1	29,5	30,5	1
25	36,5	1	35	37	1
28	38,5	1	37,5	39	1
30	42	1	41	42	1
35	47,5	1	46,5	47,5	1
40	50,5	1	49,5	50,5	1
45	58	1	57	58	1

Alignment needle roller bearings with an inner ring
d **12 – 40** mm

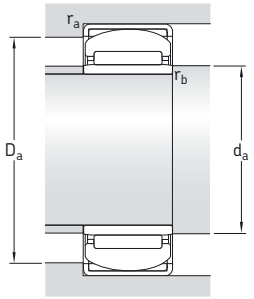


PNA



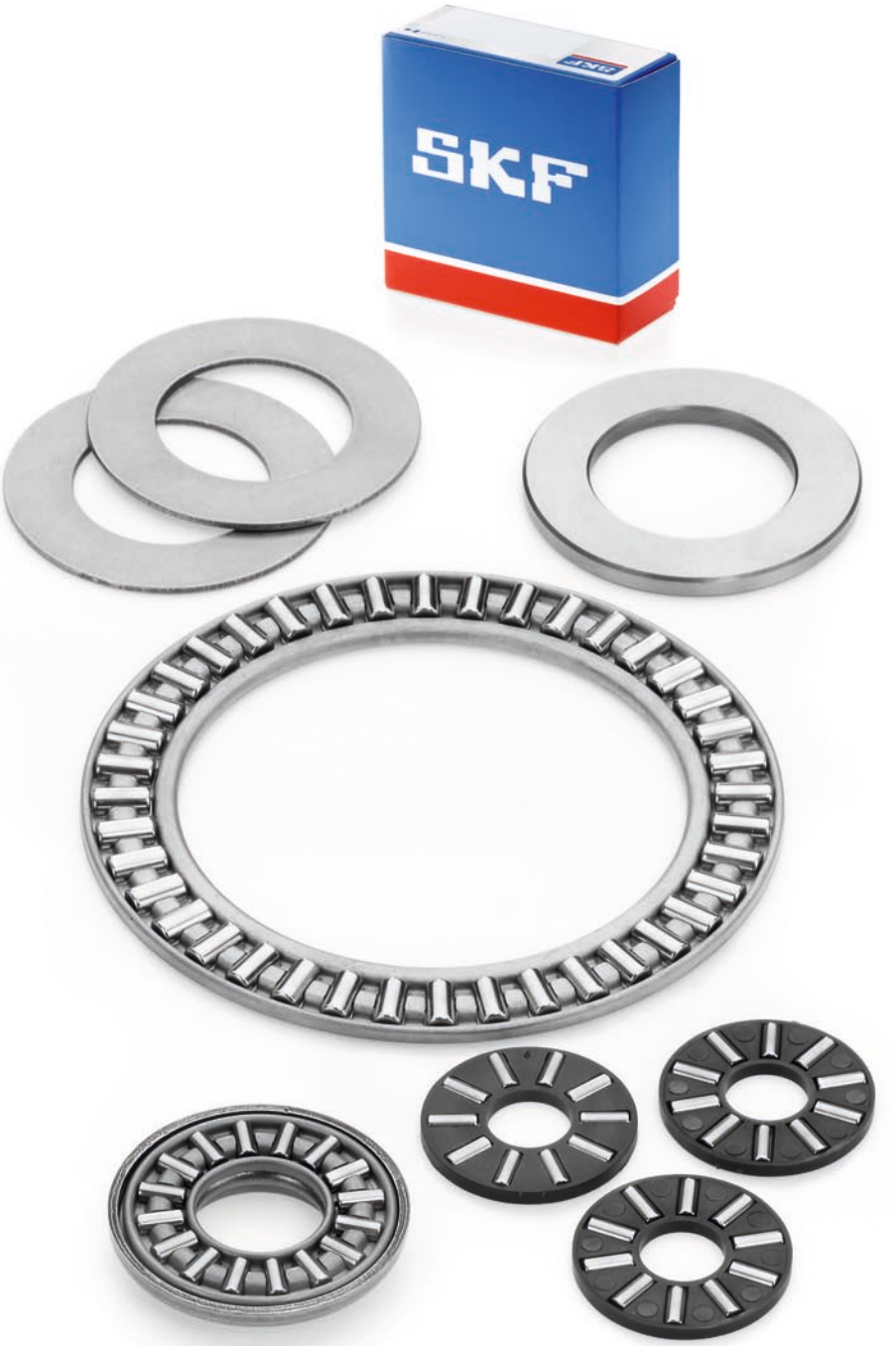
PNA

Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation
d	D	B	C	C_0	P_u				
mm			kN		kN	r/min		kg	–
12	28	12	7,37	9,15	1,08	24 000	28 000	0,037	**PNA 12/28**
15	32	16	12,8	17,6	2,12	22 000	24 000	0,062	**PNA 15/32**
17	35	16	13,2	19,3	2,28	19 000	22 000	0,073	**PNA 17/35**
20	42	20	19	32,5	4	16 000	18 000	0,14	**PNA 20/42**
22	44	20	22	36,5	4,55	14 000	16 000	0,15	**PNA 22/44**
25	47	20	22,9	38	4,8	13 000	15 000	0,16	**PNA 25/47**
30	52	20	24,6	45	5,6	11 000	13 000	0,18	**PNA 30/52**
35	55	20	26,4	51	6,3	10 000	11 000	0,18	**PNA 35/55**
40	62	20	27,5	57	7,1	9 000	10 000	0,23	**PNA 40/62**



Dimensions						Abutment and fillet dimensions				
d	F	D_1	r min	$r_{1,2}$ min	s[1]	d_a min	D_a min	D_a max	r_a max	r_b max
mm						mm				
12	15	24,5	1	0,3	0,5	14	23,5	24,5	1	0,3
15	18	27	1	0,3	0,5	17	26	27	1	0,3
17	20	30,5	1	0,3	0,5	19	29,5	30,5	1	0,3
20	25	36,5	1	0,3	0,5	22	35	37	1	0,3
22	28	38,5	1	0,3	0,5	24	37,5	39	1	0,3
25	30	42	1	0,3	0,5	25	41	42	1	0,3
30	35	47,5	1	0,3	0,5	32	46,5	47,5	1	0,3
35	40	50,5	1	0,3	0,5	37	49,5	50,5	1	0,3
40	45	58	1	0,3	0,5	42	57	58	1	0,3

[1] Permissible axial displacement from normal position of one bearing ring in relation to the other


SKF

Needle roller thrust bearings and bearing washers

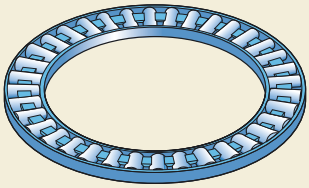
SKF needle roller thrust bearings are fitted with a form-stable cage to reliably guide and retain a large number of needle rollers. The diameter deviations of the rollers within one assembly are within 2 µm, enabling these bearings to accommodate heavy axial loads and shock loads. These bearings provide a high degree of stiffness within a minimum axial space. In applications where the faces of adjacent machine components can serve as raceways, needle roller thrust bearings will take up no more space than a conventional thrust washer. They can accommodate axial loads acting in one direction only. SKF supplies needle roller thrust bearings in two designs:

- needle roller and cage thrust assemblies, AXK series (→ **fig. 1**)
- needle roller thrust bearings with a centring spigot, AXW series (→ **fig. 2**)

For applications where adjacent components cannot serve as raceways, the assemblies can also be combined with washers of various designs.

Fig. 1

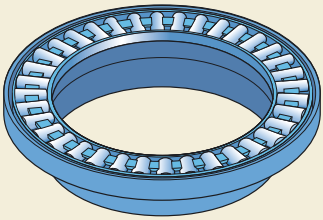
Needle roller and cage thrust assembly



AXK series

Fig. 2

Needle roller thrust bearing with a centring spigot



AXW series

Needle roller and cage thrust assemblies, AXK series

SKF needle roller and cage thrust assemblies in the AXK series (→ **fig. 1**) range from a 4 to 160 mm bore. If required, washers in the LS, AS, GS 811 or WS 811 series can be used with these assemblies.

Double direction bearings

A double direction needle roller thrust bearing can be created by combining two needle roller and cage thrust assemblies and bearing washers with an intermediate washer. Depending on the design of the intermediate washer, the bearing has internal centring (→ **fig. 3**) or external centring (→ **fig. 4**).

The intermediate washers must have the same surface finish and hardness as the bearing washers. For additional information, refer to the section *Design of associated components*, starting on **page 48**. SKF does not supply intermediate washers, but recommendations about suitable dimensions of the washers can be supplied on request.

Fig. 3

Double direction bearing arrangement with internal centring

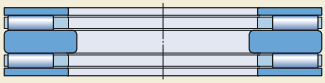
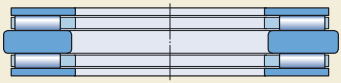


Fig. 4

Double direction bearing arrangement with external centring



Needle roller thrust bearings with a centring spigot, AXW series

SKF needle roller thrust bearings in the AXW series (→ **fig. 2**, **page 152**) consist of a needle roller and cage thrust assembly and a thrust washer with a centring spigot. The spigot facilitates the mounting process of the thrust bearing and provides an accurate radial centring of the housing washer. Available bore sizes for the thrust assembly range from 10 to 50 mm.

Combination with radial needle roller bearings

To accommodate combined radial and axial loads, AXW series needle roller thrust bearings can be combined with the following radial needle roller bearings:

- drawn cup needle roller bearings with a closed end or with open ends (→ **fig. 5**)
- needle roller bearings with machined rings (→ **fig. 6**)

These arrangements provide an economical and compact solution for combined loads.

Bearing washers

SKF bearing washers are required in cases where adjacent machine components cannot serve as raceways.

Available bore sizes for washers in the LS series range from 6 to 160 mm and in the AS series from 4 to 160 mm.

Washers in the LS and AS series can be used as a shaft washer (for AXK or AXW series needle roller thrust assemblies) or housing washer (for AXK series needle roller thrust assemblies).

Because of all the possible combinations, the appropriate washers must be ordered separately.

Raceway washers, LS series

Raceway washers in the LS series (→ **fig. 7**) are made of carbon chromium (rolling bearing) steel and are hardened. The raceway is ground and the bore and outside diameter are turned. These

Fig. 5

Needle roller thrust bearing, AXW series, combined with a drawn cup needle roller bearing

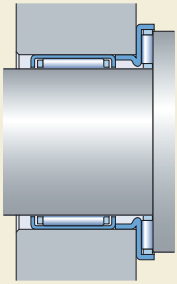


Fig. 6

Needle roller thrust bearings, AXW series, combined with a needle roller bearing with machined rings

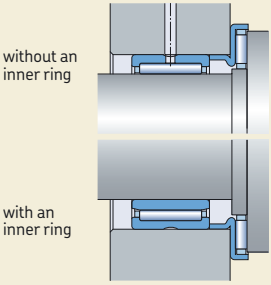
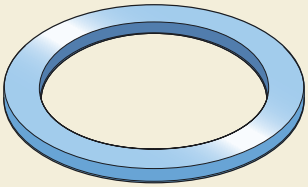


Fig. 7

Raceway washer



LS series

washers are used for bearing arrangements where accurate centring of the washers is not necessary or where low speeds are involved. The side face with the smaller chamfers is the raceway, and should face the rollers.

Thrust washers, AS series

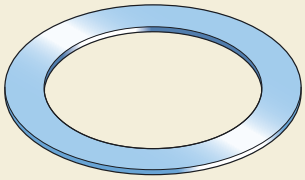
Thrust washers in the AS series (→ **fig. 8**) are made of spring steel and are 1 mm thick. Both sides of these washers, which are hardened and polished, can be used as raceways. If adjacent machine components are not hardened but have adequate stiffness and the running accuracy requirements are moderate, washers in the AS series can be used to provide a cost-effective bearing arrangement.

Shaft and housing washers, WS 811 and GS 811 series

Shaft washers in the WS 811 series (→ **fig. 9**) and housing washers in the GS 811 series (→ **fig. 10**) are developed primarily for applications with cylindrical roller and cage thrust assemblies, but they can also be combined with needle roller and cage thrust assemblies. These washers, made of carbon chromium bearing steel are hardened and have precision machined raceways. Therefore, SKF recommends using these shaft and housing washers in high-speed applications where accurate centring of the bearing washers is required. WS 811 series shaft washers, which have a ground bore, are available in bore sizes ranging from 15 to 630 mm. When combined with needle roller and cage thrust assemblies, bore sizes up to 160 mm are used. GS 811 series housing washers, which have a ground outside diameter, are available for housing bore diameters ranging from 28 mm to 750 mm. When combined with needle roller and cage thrust assemblies, outside diameter sizes up to 200 mm are used.

Fig. 8

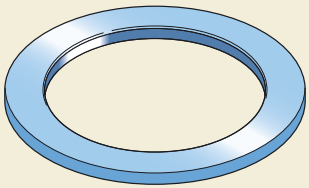
Thrust washer



AS series

Fig. 9

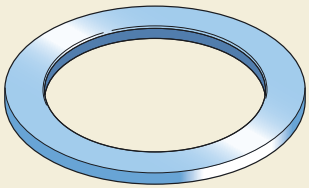
Shaft washer



WS 811 series

Fig. 10

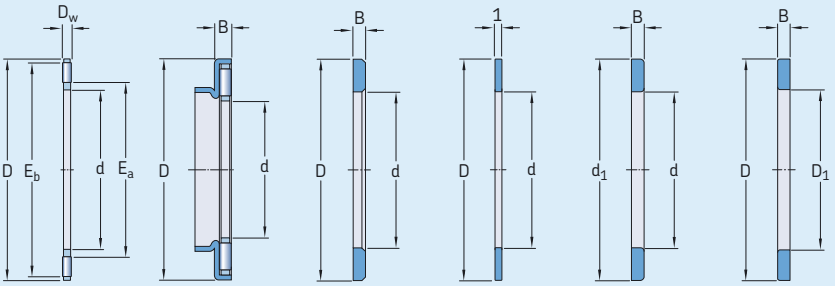
Housing washer



GS 811 series

Table 1

Tolerances for needle roller thrust bearings



AXK AXW LS AS WS 811 GS 811

Bearing component Dimensions		Tolerance, tolerance class
Needle roller and cage thrust assemblies, AXK		
Bore diameter	d	E12
Outside diameter	D	c13
Roller diameter	D_w	Grade 2, ISO 3096:1996
Needle roller thrust bearings with a centring spigot, AXW		
Bore diameter	d	E12
Outside diameter	D	–
Thickness	B	0/–0,2 mm
Roller diameter	D_w	Grade 2, ISO 3096:1996
Raceway washers, LS		
Bore diameter	d	E12
Outside diameter	D	a12
Thickness	B	h11
Axial runout	s_i	Normal, ISO 199:2005
Thrust washers, AS		
Bore diameter	d	E13
Outside diameter	D	e13
Thickness	B_1	±0,05 mm
Shaft washers, WS 811		
Bore diameter	d	Normal, ISO 199:2005
Outside diameter	d_1	–
Thickness	B	h11
Axial runout	s_i	Normal, ISO 199:2005
Housing washer, GS 811		
Outside diameter	D	Normal, ISO 199:2005
Bore diameter	D_1	–
Thickness	B	h11
Axial runout	s_e	Normal, ISO 199:2005

Table 2

ISO tolerance classes

Nominal dimension over	incl.	a12 Deviations high	low	c13 Deviations high	low	e13 Deviations high	low	h11 Deviations high	low	E12 Deviations high	low	E13 Deviations high	low
mm		µm		µm		µm		µm		µm		µm	
3	**6**	–270	–390	–70	–250	–20	–200	0	–75	+140	+20	+200	+20
6	**10**	–280	–430	–80	–300	–25	–245	0	–90	+175	+25	+245	+25
10	**18**	–290	–470	–95	–365	–32	–302	0	–110	+212	+32	+302	+32
18	**30**	–300	–510	–110	–440	–40	–370	0	–130	+250	+40	+370	+40
30	**40**	–310	–560	–120	–510	–50	–440	0	–160	+300	+50	+440	+50
40	**50**	–320	–570	–130	–520	–50	–440	0	–160	+300	+50	+440	+50
50	**65**	–340	–640	–140	–600	–60	–520	0	–190	+360	+60	+520	+60
65	**80**	–360	–660	–150	–610	–60	–520	0	–190	+360	+60	+520	+60
80	**100**	–380	–730	–170	–710	–72	–612	0	–220	+422	+72	+612	+72
100	**120**	–410	–760	–180	–720	–72	–612	0	–220	+422	+72	+612	+72
120	**140**	–460	–860	–200	–830	–85	–715	0	–250	+485	+85	+715	+85
140	**160**	–520	–920	–210	–840	–85	–715	0	–250	+485	+85	+715	+85
160	**180**	–580	–980	–230	–860	–85	–715	0	–250	+485	+85	+715	+85
180	**200**	–660	–1 120	–240	–960	–100	–820	0	–290	+560	+100	+820	+100

Dimensions

The dimensions of needle roller and cage thrust assemblies and thrust washers in the AS series are in accordance with ISO 3031:2000.

The bore and outside diameters of the other bearing washers are in accordance with ISO 104:2002 for Diameter Series 1 thrust bearings.

Tolerances

Needle roller and cage thrust assemblies, needle roller thrust bearings with a spigot, and bearing washers are manufactured to the tolerance classes listed in **table 1**. The values for the dimension deviations of the various ISO tolerance classes mentioned in **table 1** are listed in **table 2**.

Misalignment

Needle roller thrust bearings cannot tolerate any angular misalignment between the shaft and the housing, or any misalignment between the shaft and the axial support surfaces in the housing.

The ends of the needle rollers are relieved slightly to modify the line contact between the raceways and the rollers. This provides favourable load distribution in the bearing and minimizes damaging edge stresses.

Cages

SKF needle roller and cage thrust assemblies are fitted as standard with a form-stable, machined steel cage (→ **fig. 11**) or a sheet steel cage (→ **fig. 12**), except for those identified by the designation suffix TN. These assemblies have an injection moulded, glass fibre reinforced, polyamide 66 cage (→ **fig. 13**).

The complete range of needle roller thrust bearings with a centring spigot in the AXW series are fitted exclusively with steel cages.

Note
Assemblies with a polyamide 66 cage can be used at temperatures up to +120 °C.

The lubricants generally used for rolling bearings do not have a detrimental effect on cage properties. Exceptions are a few synthetic oils and greases with a synthetic oil base and lubricants containing a high proportion of EP additives when used at high temperatures.

For bearing arrangements that will operate at continuously high temperatures or under arduous conditions, SKF recommends using needle roller and cage thrust assemblies with a steel cage.

For detailed information about the temperature resistance and the applicability of cages, refer to the section *Cage materials*, starting on **page 44**.

Fig. 11

Needle roller and cage thrust assembly with a machined steel cage

Fig. 12

Needle roller and cage thrust assembly with a sheet steel cage

Fig. 13

Needle roller and cage thrust assembly with a polyamide 66 cage

Table 3

Shaft and housing tolerance classes

Thrust bearing component	Series	Shaft tolerance class Internal guidance/ centring	Housing tolerance class External guidance/ centring
Needle roller and cage thrust assemblies	AXK	h8	–
Raceway washers	LS	h8 radial space	radial space H9
Thrust washers	AS	h8 radial space	radial space H9
Shaft washers	WS 811	h8	–
Housing washers	GS 811	–	H9

Design of associated components

The support surfaces in the housing and on the shaft must be at right angles to the shaft axis and should provide uninterrupted support for the bearing washers across the entire width of the raceways. When using thrust washers in the AS series, the dimensions E_a and E_b listed in the product tables should be applied.

To provide satisfactory radial guidance for the individual thrust bearing components, suitable tolerance classes for shafts and housings are listed in **table 3**. Radial space between the shaft and the bore is required for washers that are externally guided in the housing. For washers that are internally guided on the shaft, radial space in the housing bore is required.

When SKF needle roller and cage thrust assemblies in the AXW series are combined with drawn cup needle roller bearings or needle roller bearings, the same housing tolerance must be selected for the centring spigot as for the radial bearing.

Needle roller and cage thrust assemblies are generally guided radially on the shaft in order to obtain the lowest possible sliding speed against the guiding surfaces. At high speeds, radial guidance must be provided by the shaft and the guiding surface must be ground.

Raceways on a shaft and in a housing

For detailed information about suitable materials as well as surface hardness and surface finish, refer to the section *Raceways on shafts and in housings*, starting on **page 50**.

Raceways machined on the shaft or in the housing should have the same axial runout as is common for shaft or housing washers. The values for the permissible axial runout for the shaft and housing washers of thrust bearings are listed in **table 4**.

Supplementary designations

The designation suffixes used to identify certain features of SKF needle roller thrust bearings are explained in the following.

TN Injection moulded cage of glass fibre reinforced polyamide 66, rolling element centred

Normal tolerances for thrust bearings

Shaft washer, WS 811

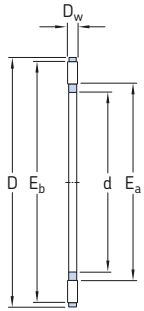
d		Δ_{dmp}		V_{dp}	S_i[1]	Δ_{Ts}[1]	
over	incl.	high	low	max	max	high	low
mm		µm		µm	µm	µm	
–	**18**	0	–8	6	10	+20	–250
18	**30**	0	–10	8	10	+20	–250
30	**50**	0	–12	9	10	+20	–250
50	**80**	0	–15	11	10	+20	–300
80	**120**	0	–20	15	15	+25	–300
120	**180**	0	–25	19	15	+25	–400

[1] Also valid where raceway washers in the LS series are used

Housing washer, GS 811

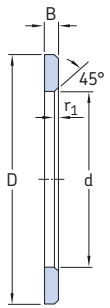
D		Δ_{Dmp}		V_{Dp}	S_e
over	incl.	high	low	max	
mm		µm		µm	µm
18	**30**	0	–13	10	10
30	**50**	0	–16	12	10
50	**80**	0	–19	14	10
80	**120**	0	–22	17	15
120	**180**	0	–25	19	15
180	**250**	0	–30	23	20

Needle roller and cage thrust assemblies and appropriate washers
d **4 – 80** mm

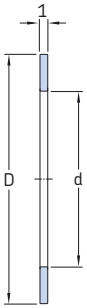


AXK

Dimensions					Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation
d	D	D_w	E_a	E_b	C	C_0	P_u				
mm					kN		kN	r/min		g	–
4	14	2	5	13	4,15	8,3	0,865	7 500	15 000	0,7	**AXK 0414 TN**
5	15	2	6	14	4,5	9,5	1	6 700	14 000	0,8	**AXK 0515 TN**
6	19	2	7	18	6,3	16	1,75	6 000	12 000	1	**AXK 0619 TN**
8	21	2	9	20	7,2	20	2,2	5 600	11 000	2	**AXK 0821 TN**
10	24	2	12	23	8,5	26	2,85	5 300	10 000	3	**AXK 1024**
12	26	2	14	25	9,15	30	3,25	5 000	10 000	3	**AXK 1226**
15	28	2	17	27	10,4	37,5	4,15	4 800	9 500	4	**AXK 1528**
17	30	2	19	29	11	40,5	4,5	4 500	9 500	4	**AXK 1730**
20	35	2	22	34	12	47,5	5,3	4 300	8 500	5	**AXK 2035**
25	42	2	29	41	13,4	60	6,7	3 800	7 500	7	**AXK 2542**
30	47	2	34	46	15	72	8	3 600	7 000	8	**AXK 3047**
35	52	2	39	51	16,6	83	9,3	3 200	6 300	10	**AXK 3552**
40	60	3	45	58	25	114	13,7	2 800	5 600	16	**AXK 4060**
45	65	3	50	63	27	127	15,3	2 600	5 300	18	**AXK 4565**
50	70	3	55	68	28,5	143	17	2 400	5 000	20	**AXK 5070**
55	78	3	60	76	34,5	186	22,4	2 200	4 300	28	**AXK 5578**
60	85	3	65	83	37,5	232	28,5	2 200	4 300	33	**AXK 6085**
65	90	3	70	88	39	255	31	2 000	4 000	35	**AXK 6590**
70	95	4	74	93	49	255	30,5	1 800	3 600	60	**AXK 7095**
75	100	4	79	98	50	265	32	1 700	3 400	61	**AXK 75100**
80	105	4	84	103	51	280	33,5	1 700	3 400	63	**AXK 80105**



LS



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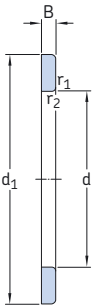
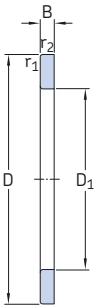


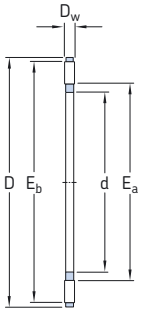
WS 811



GS 811

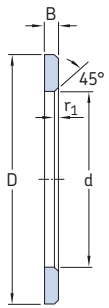
Dimensions Washers						**Masses** Washers		**Designations** Raceway washer	Thrust washer	Shaft washer	Housing washer
d	d_1	D	D_1	B	$r_{1,2}$ min	LS, WS, GS	AS				
mm						g		–			
4	–	14	–	–	–	–	1	**–**	**AS 0414**	**–**	**–**
5	–	15	–	–	–	–	1	**–**	**AS 0515**	**–**	**–**
6	–	19	–	2,75	0,3	6	2	**LS 0619**	**AS 0619**	**–**	**–**
8	–	21	–	2,75	0,3	6	2	**LS 0821**	**AS 0821**	**–**	**–**
10	–	24	–	2,75	0,3	8	3	**LS 1024**	**AS 1024**	**–**	**–**
12	–	26	–	2,75	0,3	9	3	**LS 1226**	**AS 1226**	**–**	**–**
15	28	28	16	2,75	0,3	9	3	**LS 1528**	**AS 1528**	**WS 81102**	**GS 81102**
17	30	30	18	2,75	0,3	10	4	**LS 1730**	**AS 1730**	**WS 81103**	**GS 81103**
20	35	35	21	2,75	0,3	14	5	**LS 2035**	**AS 2035**	**WS 81104**	**GS 81104**
25	42	42	26	3,00	0,6	21	7	**LS 2542**	**AS 2542**	**WS 81105**	**GS 81105**
30	47	47	32	3,00	0,6	24	8	**LS 3047**	**AS 3047**	**WS 81106**	**GS 81106**
35	52	52	37	3,50	0,6	32	9	**LS 3552**	**AS 3552**	**WS 81107**	**GS 81107**
40	60	60	42	3,50	0,6	43	12	**LS 4060**	**AS 4060**	**WS 81108**	**GS 81108**
45	65	65	47	4,00	0,6	54	13	**LS 4565**	**AS 4565**	**WS 81109**	**GS 81109**
50	70	70	52	4,00	0,6	59	14	**LS 5070**	**AS 5070**	**WS 81110**	**GS 81110**
55	78	78	57	5,00	0,6	94	18	**LS 5578**	**AS 5578**	**WS 81111**	**GS 81111**
60	85	85	62	4,75	1	110	22	**LS 6085**	**AS 6085**	**WS 81112**	**GS 81112**
65	90	90	67	5,25	1	120	24	**LS 6590**	**AS 6590**	**WS 81113**	**GS 81113**
70	95	95	72	5,25	1	130	25	**LS 7095**	**AS 7095**	**WS 81114**	**GS 81114**
75	100	100	77	5,75	1	150	27	**LS 75100**	**AS 75100**	**WS 81115**	**GS 81115**
80	105	105	82	5,75	1	160	28	**LS 80105**	**AS 80105**	**WS 81116**	**GS 81116**

Needle roller and cage thrust assemblies and appropriate washers
d **85 – 160** mm



AXK

Dimensions					Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation
d	D	D_w	E_a	E_b	C	C_0	P_u				
mm					kN		kN	r/min		g	–
85	110	4	89	108	52	290	34,5	1 700	3 400	67	**AXK 85110**
90	120	4	94	118	65,5	405	48	1 500	3 000	86	**AXK 90120**
100	135	4	105	133	76,5	560	65,5	1 400	2 800	100	**AXK 100135**
110	145	4	115	143	81,5	620	71	1 400	2 800	120	**AXK 110145**
120	155	4	125	153	86,5	680	76,5	1 300	2 600	130	**AXK 120155**
130	170	5	136	167	112	830	93	1 100	2 200	210	**AXK 130170**
140	180	5	146	177	116	900	98,6	1 000	2 000	220	**AXK 140180**
150	190	5	156	187	120	950	102	1 000	2 000	230	**AXK 150190**
160	200	5	166	197	125	1000	106	950	1 900	250	**AXK 160200**



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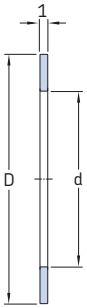

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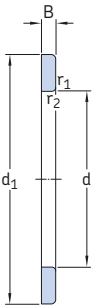
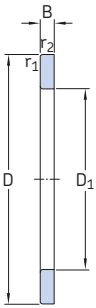


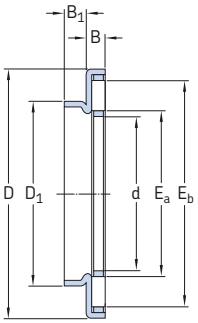
WS 811



GS 811

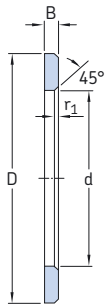
Dimensions Washers						**Masses** Washers		**Designations**			
d	d_1	D	D_1	B	$r_{1,2}$ min	LS, WS, GS	AS	Raceway washer	Thrust washer	Shaft washer	Housing washer
mm						g		–			
85	110	110	87	5,75	1	170	29	**LS 85110**	**AS 85110**	**WS 81117**	**GS 81117**
90	120	120	92	6,50	1	250	39	**LS 90120**	**AS 90120**	**WS 81118**	**GS 81118**
100	135	135	102	7,00	1	350	50	**LS 100135**	**AS 100135**	**WS 81120**	**GS 81120**
110	145	145	112	7,00	1	380	55	**LS 110145**	**AS 110145**	**WS 81122**	**GS 81122**
120	155	155	122	7,00	1	410	59	**LS 120155**	**AS 120155**	**WS 81124**	**GS 81124**
130	170	170	132	9,00	1	660	65	**LS 130170**	**AS 130170**	**WS 81126**	**GS 81126**
140	178	180	142	9,50	1	700	79	**LS 140180**	**AS 140180**	**WS 81128**	**GS 81128**
150	188	190	152	9,50	1	750	84	**LS 150190**	**AS 150190**	**WS 81130**	**GS 81130**
160	198	200	162	9,50	1	790	89	**LS 160200**	**AS 160200**	**WS 81132**	**GS 81132**

Needle roller thrust bearings with a centring spigot and appropriate washers
d **10 – 50** mm

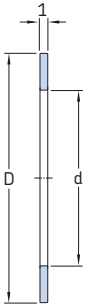


AXW

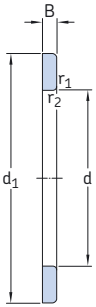
Dimensions							Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Reference speed	Limiting speed	Mass	Designation
d	D	D_1	B	B_1	E_a	E_b	C	C_0	P_u				
mm							kN		kN	r/min		g	–
10	27	14	3,2	3	12	23	8,5	26	2,85	5 300	10 000	8,3	**AXW 10**
12	29	16	3,2	3	14	25	9,15	30	3,25	5 000	10 000	9,1	**AXW 12**
15	31	21	3,2	3,5	17	27	10,4	37,5	4,15	4 800	9 500	10	**AXW 15**
17	33	23	3,2	3,5	19	29	11	40,5	4,5	4 500	9 500	11	**AXW 17**
20	38	26	3,2	3,5	22	34	12	47,5	5,3	4 300	8 500	14	**AXW 20**
25	45	32	3,2	4	29	41	13,4	60	6,7	3 800	7 500	20	**AXW 25**
30	50	37	3,2	4	34	46	15	72	8	3 600	7 000	22	**AXW 30**
35	55	42	3,2	4	39	51	16,6	83	9,3	3 200	6 300	27	**AXW 35**
40	63	47	4,2	4	45	58	25	114	13,7	2 800	5 600	39	**AXW 40**
45	68	52	4,2	4	50	63	27	127	15,3	2 600	5 300	43	**AXW 45**
50	73	58	4,2	4,5	55	68	28,5	143	17	2 400	5 000	49	**AXW 50**



LS



AS



WS 811

Dimensions Washers				**Masses** Washers		**Designations** Raceway washer	Thrust washer	Shaft washer
d	d_1, D	B	$r_{1,2}$ min	LS, WS	AS			
mm				g		–		
10	24	2,75	0,3	8	3	**LS 1024**	**AS 1024**	**–**
12	26	2,75	0,3	9	3	**LS 1226**	**AS 1226**	**–**
15	28	2,75	0,3	9	3	**LS 1528**	**AS 1528**	**WS 81102**
17	30	2,75	0,3	10	4	**LS 1730**	**AS 1730**	**WS 81103**
20	35	2,75	0,3	14	5	**LS 2035**	**AS 2035**	**WS 81104**
25	42	3,00	0,6	21	7	**LS 2542**	**AS 2542**	**WS 81105**
30	47	3,00	0,6	24	8	**LS 3047**	**AS 3047**	**WS 81106**
35	52	3,50	0,6	32	9	**LS 3552**	**AS 3552**	**WS 81107**
40	60	3,50	0,6	43	12	**LS 4060**	**AS 4060**	**WS 81108**
45	65	4,00	0,6	54	13	**LS 4565**	**AS 4565**	**WS 81109**
50	70	4,00	0,6	59	14	**LS 5070**	**AS 5070**	**WS 81110**


SKF

Combined needle roller bearings

Combined needle roller bearings consist of a radial needle roller bearing combined with a thrust bearing and are consequently able to accommodate both radial and axial loads. Combined needle roller bearings provide the means to produce locating bearing arrangements where radial space is limited. They are particularly suitable for applications where other types of locating bearings occupy too much space, or where the axial loads are too heavy, the speeds are too high, or the lubricant is inadequate for simple thrust washers. SKF supplies combined needle roller bearings in the following designs:

- needle roller / angular contact ball bearings
- needle roller / thrust ball bearings
- needle roller / cylindrical roller thrust bearings

Needle roller / angular contact ball bearings

Needle roller / angular contact ball bearings combine a radial needle roller bearing with a radial angular contact ball bearing to produce a low cross section bearing that can operate at high speeds and accommodate heavy radial and light axial loads. The radial loads are accommodated exclusively by the needle roller bearing. SKF supplies these bearings in the following two series:

- NKIA series (→ **fig. 1**), accommodates axial loads in one direction
- NKIB series (→ **fig. 2**), accommodates axial loads in both directions

Note
Bearings of both series are separable. In other words, the inner ring can be mounted separately from the outer ring, roller and cage assemblies. However, the bearings must be kept together as supplied – e.g. the outer ring, roller and cage assembly from one bearing are not interchangeable with the the roller and cage assembly from another seemingly identical bearing.

Needle roller / angular contact ball bearings, NKIA series

SKF needle roller / angular contact ball bearings in the NKIA 59 series (→ **fig. 1**) can accommodate axial loads acting in one direction and can therefore locate the shaft in one direction.

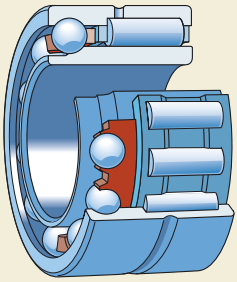
For short shafts, where changes in length as a result of thermal expansion are relatively minor, two bearings in the NKIA 59 series can be used in a back-to-back (mirrored) arrangement (→ **fig. 3**).

Needle roller / angular contact ball bearings, NKIB series

Needle roller / angular contact ball bearings in the NKIB 59 series (→ **fig. 2**) are able to locate

Fig. 1

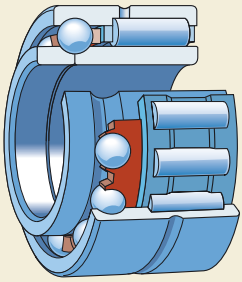
Needle roller / angular contact ball bearing



NKIA 59 series

Fig. 2

Needle roller / angular contact ball bearing



NKIB 59 series

a shaft in both directions with an axial play between 0,08 and 0,25 mm. To facilitate mounting, the bearing has a two-piece inner ring. When mounting the inner ring, it is important that the two pieces are mounted immediately adjacent to each other without any gap between them.

Dimensions

The boundary dimensions of bearings in the NKIA 59 series are in accordance with Dimension Series 59 of ISO 15:1998.

With the exception of the inner ring width, which is extended on one side, the boundary dimensions of bearings in the NKIB 59 series are in accordance with Dimension Series 59 of ISO 15:1998.

Tolerances

SKF supplies needle roller / angular contact ball bearings to Normal tolerances in accordance with ISO 492:2002 as standard.

The following tolerances in the NKIB 59 series are exceptions:

- The bore diameter of the narrow part of the inner ring is slightly larger.
- The width tolerances of the complete inner ring is 0/–0,3 mm for all sizes.

Internal clearance

SKF supplies needle roller / angular contact ball bearings with Normal radial internal clearance as standard.

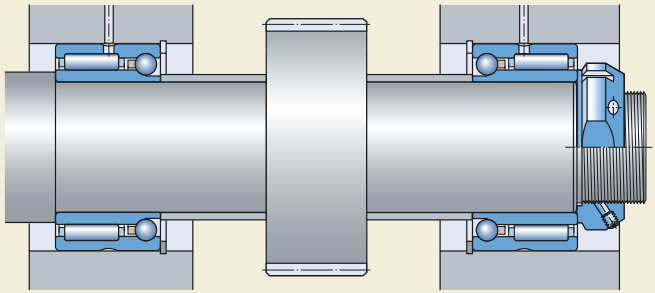
The values for radial internal clearance are listed in **table 7** on **page 42** and are in accordance with ISO 5753:1991. They are valid for unmounted bearings under zero measuring load.

Misalignment

SKF needle rollers are relieved slightly toward their ends. The modified line contact achieved between the raceways and the needle rollers provides favourable load distribution in the bearing and minimizes damaging edge stresses. It also enables needle roller / angular contact ball bearings to accommodate a minimum amount of misalignment. The detrimental effect of misalignment increases with increasing bearing width and load. Needle roller / angular contact ball bearings are sensitive to misalignment. If misalignment can not be avoided, contact the SKF application engineering service.

Fig. 3

NKIA 59 series, back-to-back arrangement



Cages

The radial needle roller bearing is fitted as standard with a machined steel cage (→ **fig. 4**) or a sheet steel cage (→ **fig. 5**). The balls of the angular contact ball bearing are retained in an injection moulded cage made of glass fibre reinforced polyamide 66 (→ **fig. 6**).

Note

Limited by the polyamide 66 cage, needle roller / angular contact ball bearings should not be operated at temperatures above 120 °C.

The lubricants generally used for rolling bearings do not have a detrimental effect on cage properties. Exceptions are a few synthetic oils and greases with a synthetic oil base and lubricants containing a high proportion of EP additives when used at high temperatures.

For detailed information about the temperature resistance and the applicability of cages, refer to the section *Cage materials*, starting on **page 44**.

Shaft and housing tolerances

For needle roller / angular contact ball bearings SKF recommends machining the shaft seat to a k5 tolerance class, and the housing bore seat to an M6 tolerance class.

Tighter fits than those achieved with these tolerance classes should be avoided as they could have a negative influence on bearing performance.

In addition to their interference fit on the shaft and in the housing, the bearing rings should be located axially by a shaft shoulder or snap ring.

Fig. 4

Machined steel cage of the radial bearing

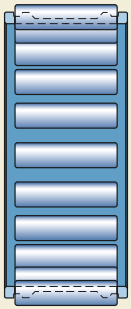


Fig. 5

Sheet steel cage of the radial bearing

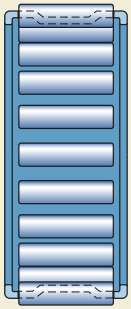


Fig. 6

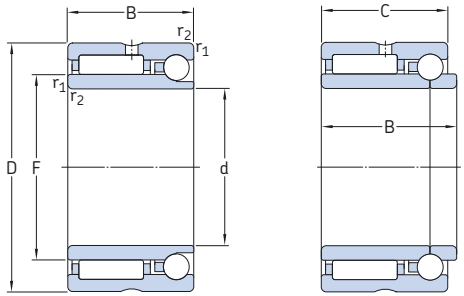
Polyamide 66 cage of the angular contact ball bearing

Lubrication

To facilitate efficient lubrication, the needle roller bearing has an annular groove with one lubrication hole in the outer ring. Depending on the application, needle roller / angular contact ball bearings can be grease or oil lubricated. In the case of grease lubrication, both the needle roller bearing and ball bearing should be filled with the same lubricant. If grease lubrication is going to be used, the bearing should be lubricated before mounting.

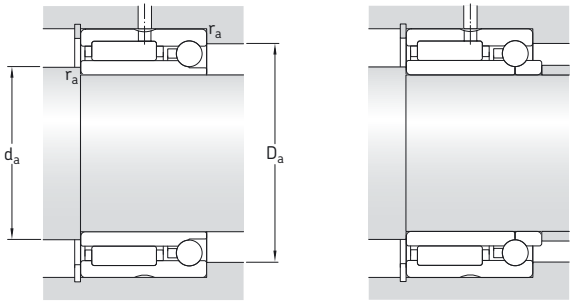
Relubrication intervals for the needle roller and angular contact ball bearing must be calculated separately. The lower of the two intervals should be used.

For additional information about lubrication, refer to the section *Lubrication*, starting on **page 52**.

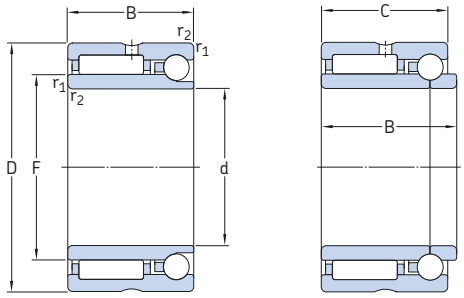


NKIA NKIB

Principal dimensions				Basic load ratings radial		axial		Fatigue load limits radial	axial	Speed ratings Reference speed	Limiting speed	Mass	Designation
d	D	B	C	dynamic C	static C_0	dynamic C	static C_0	P_u	P_u				
mm				kN				kN		r/min		kg	–
12	24	16	–	8,25	10	2,07	1,92	1,14	0,083	22 000	26 000	0,04	**NKIA 5901**
	24	17,5	16	8,25	10	2,07	1,92	1,14	0,083	22 000	26 000	0,043	**NKIB 5901**
15	28	18	–	11,4	15,6	2,27	2,37	1,83	0,099	19 000	22 000	0,05	**NKIA 5902**
	28	20	18	11,4	15,6	2,27	2,37	1,83	0,099	19 000	22 000	0,052	**NKIB 5902**
17	30	18	–	11,7	17	2,24	2,74	1,96	0,116	18 000	20 000	0,056	**NKIA 5903**
	30	20	18	11,7	17	2,24	2,74	1,96	0,116	18 000	20 000	0,058	**NKIB 5903**
20	37	23	–	21,6	28	3,79	4,21	3,35	0,176	15 000	17 000	0,1	**NKIA 5904**
	37	25	23	21,6	28	3,79	4,21	3,35	0,176	15 000	17 000	0,11	**NKIB 5904**
22	39	23	–	23,3	32	4,14	4,93	3,9	0,205	14 000	15 000	0,12	**NKIA 59/22**
	39	25	23	23,3	32	4,14	4,93	3,9	0,205	14 000	15 000	0,12	**NKIB 59/22**
25	42	23	–	24,2	34,5	4,24	5,26	4,15	0,224	13 000	15 000	0,13	**NKIA 5905**
	42	25	23	24,2	34,5	4,24	5,26	4,15	0,224	13 000	15 000	0,13	**NKIB 5905**
30	47	23	–	25,5	39	4,54	6,32	4,65	0,268	11 000	13 000	0,15	**NKIA 5906**
	47	25	23	25,5	39	4,54	6,32	4,65	0,268	11 000	13 000	0,15	**NKIB 5906**
35	55	27	–	31,9	54	5,83	8,42	6,7	0,355	9 500	11 000	0,24	**NKIA 5907**
	55	30	27	31,9	54	5,83	8,42	6,7	0,355	9 500	11 000	0,25	**NKIB 5907**
40	62	30	–	42,9	71	7,17	10,9	8,8	0,467	8 000	9 500	0,32	**NKIA 5908**
	62	34	30	42,9	71	7,17	10,9	8,8	0,467	8 000	9 500	0,32	**NKIB 5908**
45	68	30	–	45,7	78	7,47	12	9,65	0,513	7 500	8 500	0,38	**NKIA 5909**
	68	34	30	45,7	78	7,47	12	9,65	0,513	7 500	8 500	0,38	**NKIB 5909**
50	72	30	–	47,3	85	7,74	13,7	10,6	0,579	7 000	8 000	0,38	**NKIA 5910**
	72	34	30	47,3	85	7,74	13,7	10,6	0,579	7 000	8 000	0,39	**NKIB 5910**
55	80	34	–	57,2	104	9,27	16,7	13,2	0,697	6 300	7 000	0,55	**NKIA 5911**
	80	38	34	57,2	104	9,27	16,7	13,2	0,697	6 300	7 000	0,56	**NKIB 5911**
60	85	34	–	59,4	114	9,58	18	14,3	0,77	6 000	6 700	0,59	**NKIA 5912**
	85	38	34	59,4	114	9,58	18	14,3	0,77	6 000	6 700	0,6	**NKIB 5912**

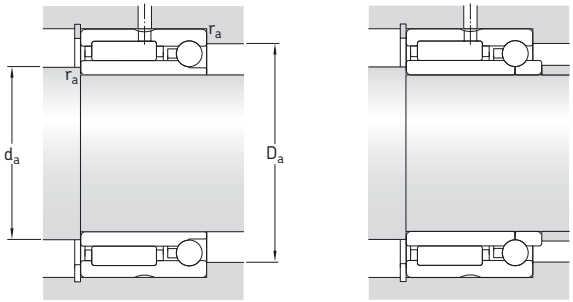


Dimensions			Abutment and fillet dimensions		
d	F	$r_{1,2}$ min	d_a min	D_a max	r_a max
mm			mm		
12	16	0,3	14	22	0,3
	16	0,3	14	22	0,3
15	20	0,3	17	26	0,3
	20	0,3	17	26	0,3
17	22	0,3	19	28	0,3
	22	0,3	19	28	0,3
20	25	0,3	22	35	0,3
	25	0,3	22	35	0,3
22	28	0,3	24	37	0,3
	28	0,3	24	37	0,3
25	30	0,3	27	40	0,3
	30	0,3	27	40	0,3
30	35	0,3	32	45	0,3
	35	0,3	32	45	0,3
35	42	0,6	39	51	0,6
	42	0,6	39	51	0,6
40	48	0,6	44	58	0,6
	48	0,6	44	58	0,6
45	52	0,6	49	64	0,6
	52	0,6	49	64	0,6
50	58	0,6	54	68	0,6
	58	0,6	54	68	0,6
55	63	1	60	75	1
	63	1	60	75	1
60	68	1	65	80	1
	68	1	65	80	1



NKIA NKIB

Principal dimensions				Basic load ratings radial		axial		Fatigue load limits		Speed ratings Reference speed	Limiting speed	Mass	Designation
				dynamic	static	dynamic	static	radial	axial				
d	D	B	C	C	C_0	C	C_0	P_u	P_u				
mm				kN				kN		r/min		kg	–
65	90	34	–	60,5	118	9,96	19,2	14,6	0,816	5 600	6 300	0,64	**NKIA 5913**
	90	38	34	60,5	118	9,96	19,2	14,6	0,816	5 600	6 300	0,64	**NKIB 5913**
70	100	40	–	84,2	163	13,2	25	20,8	1,05	5 000	5 600	0,98	**NKIA 5914**
	100	45	40	84,2	163	13,2	25	20,8	1,05	5 000	5 600	0,99	**NKIB 5914**



Dimensions			Abutment and fillet dimensions		
d	F	$r_{1,2}$ min	d_a min	D_a max	r_a max
mm			mm		
65	72	1	70	85	1
	72	1	70	85	1
70	80	1	75	95	1
	80	1	75	95	1

Needle roller / thrust ball bearings

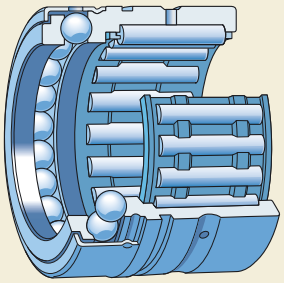
Needle roller / thrust ball bearings combine a radial needle roller bearing and a thrust ball bearing. SKF supplies these bearings in the following two series:

- NX series (→ **fig. 7**), a needle roller bearing with a full complement thrust ball bearing
- NKX series (→ **fig. 8**), a needle roller bearing with a thrust ball bearing with a cage

SKF supplies the bearings in both series without an inner ring. However, for applications where it is not possible to harden and grind the shaft, the needle roller bearing can be combined with an inner ring (→ **fig. 9**). Appropriate inner rings are listed in the product tables and can be ordered separately.

Fig. 7

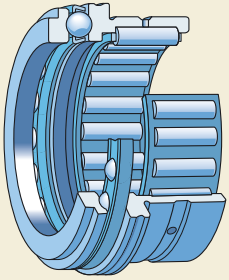
Needle roller / thrust ball bearing



NX series

Fig. 8

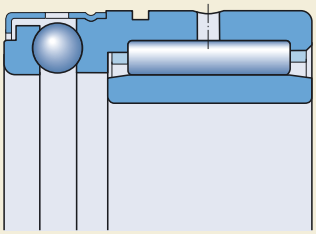
Needle roller / thrust ball bearing



NKX series

Fig. 9

Needle roller / thrust ball bearing, combined with an inner ring



NX series

Needle roller / thrust ball bearings, NX series

SKF needle roller / full complement thrust ball bearings in the NX series are suitable for applications where there are moderate radial loads and lighter, single direction axial loads. Their extremely low sectional height enables shaft centrelines to be positioned close together as is the case for multi-spindle drilling machines.

For axial support, the bearings may be mounted against a shoulder or snap ring in the housing bore. The snap ring groove in the outer ring provides a cost-effective and axially space-saving arrangement (→ **fig. 10**). The appropriate snap rings are listed in the product tables.

Needle roller / thrust ball bearings in the NX series have a stamped steel cover that extends over the shaft washer of the thrust ball bearing and is firmly attached to the radial needle roller bearing. These bearings are therefore non-separable. Bearings in the NX series have lubrication holes in the cover (→ **fig. 11**) and are intended for oil lubrication.

Bearings in the NX .. Z series (→ **fig. 12**) should be grease lubricated. SKF supplies the thrust ball bearing in this series filled, as standard, with a high-quality grease with good rust inhibiting properties. The cover, which has no lubrication holes, forms a gap-type seal with the shaft washer to retain the grease in the bearing.

Fig. 10

NX series mounted with a snap ring

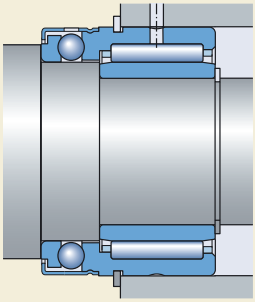
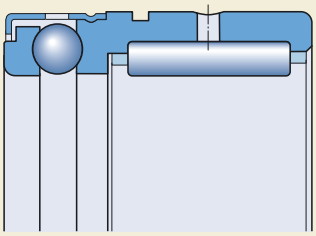


Fig. 11

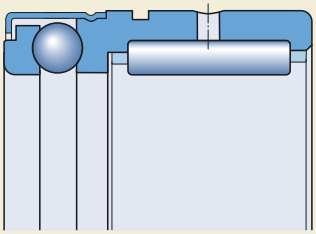
Needle roller / thrust ball bearing, with lubrication holes in the cover



NX series

Fig. 12

Needle roller / thrust ball bearing, no lubrication holes in the cover



NX .. Z series

Needle roller / thrust ball bearings, NKX series

SKF needle roller / thrust ball bearings in the NKX series combine a radial needle roller bearing and a thrust ball bearing based on the 511 series. They are able to support single-direction axial loads in addition to radial loads. They also permit relatively high-speed operation.

NKX series needle roller / thrust ball bearings (→ **fig. 13**) do not have a cover around the thrust ball bearing. As a result, both the ball and cage assembly and shaft washer can be mounted separately from the rest of the bearing.

NKX .. Z series needle roller / thrust ball bearings (→ **fig. 14**) are non-separable. They have a stamped steel cover that extends over the shaft washer of the thrust ball bearing. It is firmly attached to the housing washer that is integral to the needle roller bearing outer ring. The cover makes these bearings non-separable. SKF supplies the thrust ball bearing in this series filled, as standard, with a high-quality grease that has good rust inhibiting properties. The cover, which has no lubrication holes, forms a gap-type seal with the shaft washer to retain the grease in the bearing.

Dimensions

The boundary dimensions of needle roller / thrust ball bearings in the NKX and NKX .. Z series are in accordance with DIN 5429-1:2005-08.

The dimensions of bearings in the NX and NX .. Z series are not standardized, but are common in the market.

Tolerances

SKF needle roller / thrust ball bearings are manufactured to the tolerances and tolerance classes listed in **table 1**. The radial runout values are in accordance with ISO 492:2002 and the Normal axial runout values are in accordance with ISO 199:2005.

The values for the deviations from the nominal diameter of the ISO tolerance classes F6 and E8 in **table 1** are listed in **table 2**.

Shaft and housing tolerances

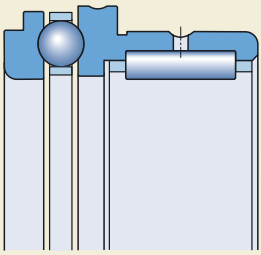
SKF recommends machining the shaft seat to a k5 tolerance class for bearings with or without an inner ring.

For the housing bore seat, SKF recommends a K6 tolerance class. For stiff bearing arrangements, SKF recommends an M6 housing bore tolerance class.

In addition to their interference fit on the shaft and in the housing, the bearing rings must be axially located by a shoulder or snap ring.

Fig. 13

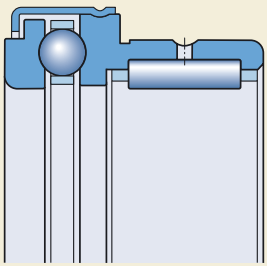
Needle roller / thrust ball bearing



NKX series

Fig. 14

Needle roller / thrust ball bearing



NKX .. Z series

Internal clearance

SKF needle roller / thrust ball bearings combined with the appropriate inner ring, as listed in the product tables, have Normal radial internal clearance as standard. The clearance values are listed in **table 7** on **page 42** and are in accordance with ISO 5753:1991. They are valid for unmounted bearings under zero measuring load.

The radial internal clearance for SKF needle roller / thrust ball bearings without an inner ring depends on the shaft tolerance. If the recommended k5 shaft tolerance class is applied, the tolerance for the inside diameter F_w will provide an internal clearance that is slightly less than the Normal radial internal clearance.

Misalignment

SKF needle roller / thrust ball bearings in the NX and NKX series cannot tolerate any angular misalignment between the shaft and the housing or any misalignment between the shaft and the axial support surfaces in the housing.

Table 1

Needle roller / thrust ball bearing tolerances

Dimension[1]		Tolerance, tolerance class
Outside diameter	D	Normal, ISO 492:1994
Inside diameter of needle roller complement	F_w	F6
Bore diameter	d	E8
Width	C	0/–0,25 mm
Width[2]	C_1	0/–0,20 mm

[1] Refer to the illustrations in the product tables, starting on **page 184**.
[2] Applicable to bearings in the NKX and NKX .. Z series only

Table 2

ISO tolerance classes

Nominal diameter over	incl.	E8 Deviations high	low	F6 Deviations high	low
mm		µm		µm	
6	**10**	+47	+25	+22	+13
10	**18**	+59	+32	+27	+16
18	**30**	+73	+40	+33	+20
30	**50**	+89	+50	+41	+25
50	**80**	+106	+60	+49	+30

Cages

The radial needle roller bearing is fitted as standard with a machined steel (→ **fig. 4**, **page 172**) or a sheet steel cage (→ **fig. 5**, **page 172**), no designation suffix. However, some small bearings are fitted as standard with an injection moulded cage of glass fibre reinforced polyamide 66 (→ **fig. 15**), designation suffix TN.

The cage, that retains the balls of the thrust ball bearing (NKX series), is made of sheet steel (→ **fig. 16**).

Note

Needle roller / thrust ball bearings with a polyamide 66 cage should not be operated at temperatures above 120 °C.

The lubricants generally used for rolling bearings do not have a detrimental effect on cage properties. Exceptions are a few synthetic oils and greases with a synthetic oil base and lubricants containing a high proportion of EP additives when used at high temperatures.

For bearing arrangements that will operate at continuously high temperatures or under arduous conditions, SKF recommends using needle roller / thrust ball bearings with steel cages.

For detailed information about the temperature resistance and the applicability of cages, refer to the section *Cage materials*, starting on **page 44**.

Fig. 15

Polyamide 66 cage of the radial bearing

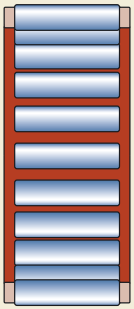
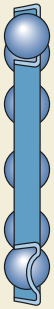


Fig. 16

Sheet steel cage of the thrust ball bearing, NKX series



Lubrication

To facilitate efficient lubrication, the needle roller bearing has an annular groove with one lubrication hole in the outer ring.

The shielded thrust bearing of needle roller / thrust ball bearings with the designation suffix Z is filled at the factory with a high-quality grease that has good corrosion inhibiting properties. For relubrication, SKF recommends SKF LGWA 2 grease. For additional information about greases, refer to the section *Lubrication*, starting on **page 52**.

Bearings in the NKX and NX series without the designation suffix Z should be oil lubricated whenever possible, as oil facilitates an adequate supply of lubricant to the bearing.

Relubrication intervals for the axial and radial components must be calculated separately. The lower of the two intervals should be used. A calculation is needed for both oil and grease lubrication.

Design of associated components

The diameter of the support surface for the integral housing washer of a needle roller / thrust ball bearing must always be at least 0,5 mm larger than the dimension D_1 or D_2 (→ **fig. 17**) to obtain a clearance fit. The values for the diameters D_1 and D_2 are listed in the product table.

Application recommendations

SKF needle roller / thrust ball bearings can locate a shaft axially in one direction only. For short shafts, where changes in length as a result of thermal expansion are relatively minor, two bearings can be used in a back-to-back (mirrored) arrangement (→ **fig. 18**). In these cases SKF recommends elastically preloading the thrust ball bearings with cup springs (belleville washers). This elastic preload helps to avoid skidding of the balls when one of the thrust bearings is unloaded and facilitates proper and quiet performance of the thrust ball bearing.

Supplementary designations

The designation suffixes used to identify certain features of SKF needle roller / thrust ball bearings are explained in the following.

Z Thrust ball bearing with a cover over the outside diameter without lubrication holes. Filled at the factory with a high-quality lithium base NLGI 2 grease.

Fig. 17

Clearance fit for the integral housing washer

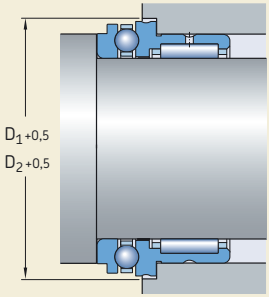
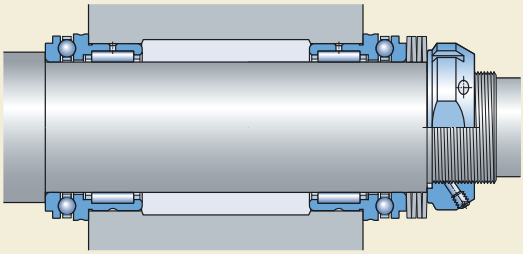
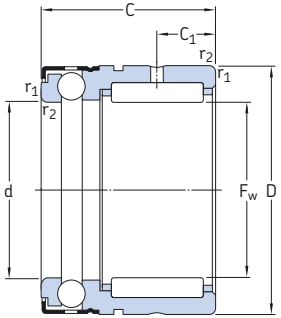


Fig. 18

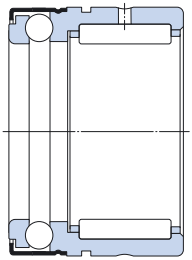
NKX series, back-to-back arrangement, incorporating belleville washers



Needle roller / thrust ball bearings, full complement thrust bearing
F_w **7 – 35** mm



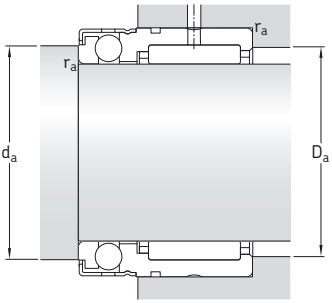
NX

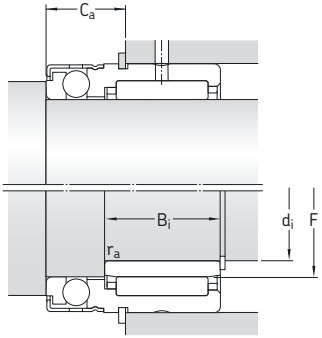


NX .. Z

Principal dimensions			Basic load ratings radial		axial		Fatigue load limits		Min. load factor	Speed ratings Reference speed	Limiting speed	Mass	Designation
			dynamic	static	dynamic	static	radial	axial					
F_w	D	C	C	C_0	C	C_0	P_u	P_u	A				
mm			kN				kN		–	r/min		kg	–
7	14	18	2,81	2,75	3,45	5	0,29	0,186	0,13	10 000	11 000	0,014	**NX 7 TN**[1]
	14	18	2,81	2,75	3,45	5	0,29	0,186	0,13	10 000	6 000	0,014	**NX 7 ZTN**[1]
10	19	18	4,68	4,15	5,07	8,5	0,475	0,31	0,38	8 500	9 500	0,025	**NX 10**
	19	18	4,68	4,15	5,07	8,5	0,475	0,31	0,38	8 500	5 600	0,025	**NX 10 Z**
12	21	18	5,5	5,4	5,27	9,65	0,61	0,355	0,48	8 000	9 000	0,028	**NX 12**
	21	18	5,5	5,4	5,27	9,65	0,61	0,355	0,48	8 000	5 300	0,028	**NX 12 Z**
15	24	28	11,2	14	6,18	12,2	1,66	0,45	0,77	7 500	8 500	0,048	**NX 15**
	24	28	11,2	14	6,18	12,2	1,66	0,45	0,77	7 500	5 300	0,048	**NX 15 Z**
17	26	28	12,3	16,6	6,37	13,4	1,96	0,5	0,93	7 000	8 500	0,053	**NX 17**
	26	28	12,3	16,6	6,37	13,4	1,96	0,5	0,93	7 000	5 000	0,053	**NX 17 Z**
20	30	28	13,4	19,6	7,8	17,3	2,28	0,64	1,6	6 300	7 500	0,068	**NX 20**
	30	28	13,4	19,6	7,8	17,3	2,28	0,64	1,6	6 300	4 500	0,068	**NX 20 Z**
25	37	30	15,4	25	12,4	28,5	2,9	1,06	4,2	5 600	6 300	0,12	**NX 25**
	37	30	15,4	25	12,4	28,5	2,9	1,06	4,2	5 600	3 800	0,12	**NX 25 Z**
30	42	30	22,9	39	12,7	32,5	4,8	1,2	5,5	5 300	6 000	0,13	**NX 30**
	42	30	22,9	39	12,7	32,5	4,8	1,2	5,5	5 300	3 600	0,13	**NX 30 Z**
35	47	30	24,6	45	13,5	38	5,6	1,4	7,5	5 000	5 600	0,16	**NX 35**
	47	30	24,6	45	13,5	38	5,6	1,4	7,5	5 000	3 400	0,16	**NX 35 Z**

[1] Radial bearing with inserted closure ring

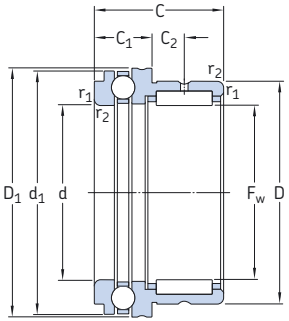




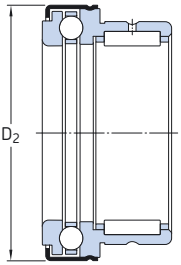
Dimensions				**Abutment and fillet dimensions**				**Appropriate inner ring**[2] Dimensions			Designation	**Appropriate snap ring**[3] Designation
F_w	C_1	d	$r_{1,2}$ min	d_a	D_a max	C_a	r_a max	d_i	F	B_i		
mm				mm				mm			–	–
7	4,7	7	0,3	9,5	12	10	0,3	–	–	–	–	SW 14
	4,7	7	0,3	9,5	12	10	0,3	–	–	–	–	SW 14
10	4,7	10	0,3	14,5	17	10	0,3	6	10	10	IR 6×10×10 IS1	SW 19
	4,7	10	0,3	14,5	17	10	0,3	6	10	10	IR 6×10×10 IS1	SW 19
12	4,7	12	0,3	16,5	19	10	0,3	8	12	10	IR 8×12×10 IS1	SW 21
	4,7	12	0,3	16,5	19	10	0,3	8	12	10	IR 8×12×10 IS1	SW 21
15	8	15	0,3	19	22	12,2	0,3	12	15	16	IR 12×15×16	SW 24
	8	15	0,3	19	22	12,2	0,3	12	15	16	IR 12×15×16	SW 24
17	8	17	0,3	21	24	12,2	0,3	14	17	17	IR 14×17×17	SW 26
	8	17	0,3	21	24	12,2	0,3	14	17	17	IR 14×17×17	SW 26
20	8	20	0,3	25	28	12,2	0,3	17	20	16	IR 17×20×16	SW 30
	8	20	0,3	25	28	12,2	0,3	17	20	16	IR 17×20×16	SW 30
25	8	25	0,3	31,5	35	14,2	0,3	20	25	16	IR 20×25×16 IS1	SW 37
	8	25	0,3	31,5	35	14,2	0,3	20	25	16	IR 20×25×16 IS1	SW 37
30	10	30	0,3	36,5	40	14,2	0,3	25	30	20	IR 25×30×20	SW 42
	10	30	0,3	36,5	40	14,2	0,3	25	30	20	IR 30×35×20	SW 42
35	10	35	0,3	40,5	45	14,2	0,3	30	35	20	IR 25×30×20	SW 47
	10	35	0,3	40,5	45	14,2	0,3	30	35	20	IR 30×35×20	SW 47

[2] For additional information, refer to the section *Needle roller bearing inner rings*, starting on **page 196**.
[3] In accordance with DIN 471, not supplied by SKF

Needle roller / thrust ball bearings, thrust bearing with a cage
F_w **10 – 70** mm



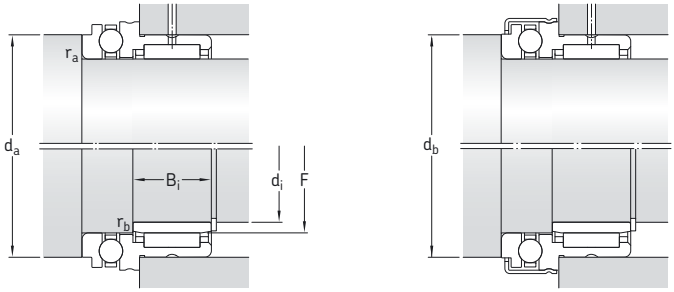
NKX



NKX .. Z

Principal dimensions			Basic load ratings radial		axial		Fatigue load limits radial	axial	Min. load factor	Speed ratings Reference speed	Limiting speed	Mass	Designation
			dynamic	static	dynamic	static							
F_w	D	C	C	C_0	C	C_0	P_u	P_u	A				
mm			kN				kN		–	r/min		kg	–
10	19	23	5,94	8	9,95	15,3	0,9	0,56	1,2	9 500	13 000	0,034	**NKX 10 TN**[1]
	19	23	5,94	8	9,95	15,3	0,9	0,56	1,2	9 500	8 000	0,036	**NKX 10 ZTN**[1]
12	21	23	6,16	8,65	10,4	16,6	0,98	0,62	1,4	9 000	13 000	0,038	**NKX 12**
	21	23	6,16	8,65	10,4	16,6	0,98	0,62	1,4	9 000	7 500	0,04	**NKX 12 Z**
15	24	23	11,2	14	10,6	18,3	1,66	0,67	1,7	8 500	12 000	0,044	**NKX 15**
	24	23	11,2	14	10,6	18,3	1,66	0,67	1,7	8 500	7 000	0,047	**NKX 15 Z**
17	26	25	12,3	16,6	10,8	19,6	1,96	0,735	2	8 500	12 000	0,053	**NKX 17**
	26	25	12,3	16,6	10,8	19,6	1,96	0,735	2	8 500	7 000	0,055	**NKX 17 Z**
20	30	30	16,8	26	14,3	27	3,05	1	3,8	7 500	10 000	0,083	**NKX 20**
	30	30	16,8	26	14,3	27	3,05	1	3,8	7 500	6 000	0,09	**NKX 20 Z**
25	37	30	19	32,5	19,5	40,5	4	1,5	8,5	6 300	9 000	0,13	**NKX 25**
	37	30	19	32,5	19,5	40,5	4	1,5	8,5	6 300	5 500	0,13	**NKX 25 Z**
30	42	30	22,9	39	20,3	45,5	4,8	1,7	10	6 000	8 500	0,14	**NKX 30**
	42	30	22,9	39	20,3	45,5	4,8	1,7	10	6 000	5 000	0,15	**NKX 30 Z**
35	47	30	24,6	45	21,2	51	5,6	1,9	13	5 600	7 500	0,16	**NKX 35**
	47	30	24,6	45	21,2	51	5,6	1,9	13	5 600	4 500	0,17	**NKX 35 Z**
40	52	32	26,4	51	27	68	6,3	2,55	24	5 000	7 000	0,2	**NKX 40**
	52	32	26,4	51	27	68	6,3	2,55	24	5 000	4 000	0,21	**NKX 40 Z**
45	58	32	28,1	57	28,1	75	7,1	2,8	29	4 500	6 300	0,25	**NKX 45**
	58	32	28,1	57	28,1	75	7,1	2,8	29	4 500	3 800	0,27	**NKX 45 Z**
50	62	35	38	80	28,6	81,5	9,65	3,05	34	4 300	6 300	0,28	**NKX 50**
	62	35	38	80	28,6	81,5	9,65	3,05	34	4 300	3 600	0,3	**NKX 50 Z**
60	72	40	41,8	96,5	41,6	122	11,8	4,55	77	3 600	5 000	0,36	**NKX 60**
	72	40	41,8	96,5	41,6	122	11,8	4,55	77	3 600	3 000	0,38	**NKX 60 Z**
70	85	40	44,6	98	43,6	137	12,2	5,1	97	3 400	4 500	0,5	**NKX 70**
	85	40	44,6	98	43,6	137	12,2	5,1	97	3 400	2 700	0,52	**NKX 70 Z**

[1] Radial bearing with inserted closure ring



Dimensions								Abutment and fillet dimensions							Appropriate inner ring[2] Designation
F_w	C_1	C_2	d	d_1	D_1	D_2	$r_{1,2}$ min	d_a min	d_b max	r_a max	r_b max	d_i	F	B_i	
mm							mm								–
10	9	6,5	10	24	24	–	0,3	19	–	0,3	0,3	7	10	16	IR 7×10×16
	9	6,5	10	19,7	–	25,2	0,3	19	19,7	0,3	0,3	7	10	16	IR 7×10×16
12	9	6,5	12	26	26	–	0,3	21	–	0,3	0,3	9	12	16	IR 9×12×16
	9	6,5	12	21,7	–	27,2	0,3	21	21,7	0,3	0,3	9	12	16	IR 9×12×16
15	9	6,5	15	28	28	–	0,3	23	–	0,3	0,3	12	15	16	IR 12×15×16
	9	6,5	15	23,7	–	29,2	0,3	23	23,7	0,3	0,3	12	15	16	IR 12×15×16
17	9	8	17	30	30	–	0,3	25	–	0,3	0,3	14	17	17	IR 14×17×17
	9	8	17	25,7	–	31,1	0,3	25	25,7	0,3	0,3	14	17	17	IR 14×17×17
20	10	10,5	20	35	35	–	0,3	29	–	0,3	0,3	17	20	20	IR 17×20×20
	10	10,5	20	30,7	–	36,2	0,3	29	30,7	0,3	0,3	17	20	20	IR 17×20×20
25	11	9,5	25	42	42	–	0,6	35	–	0,6	0,3	20	25	20	IR 20×25×20
	11	9,5	25	37,7	–	43,2	0,6	35	37,7	0,6	0,3	20	25	20	IR 20×25×20
30	11	9,5	30	47	47	–	0,6	40	–	0,6	0,3	25	30	20	IR 25×30×20
	11	9,5	30	42,7	–	48,2	0,6	40	42,7	0,6	0,3	25	30	20	IR 25×30×20
35	12	9	35	52	52	–	0,6	45	–	0,6	0,3	30	35	20	IR 30×35×20
	12	9	35	47,7	–	53,2	0,6	45	47,7	0,6	0,3	30	35	20	IR 30×35×20
40	13	10	40	60	60	–	0,6	52	–	0,6	0,3	35	40	20	IR 35×40×20
	13	10	40	55,7	–	61,2	0,6	52	55,7	0,6	0,3	35	40	20	IR 35×40×20
45	14	9	45	65	65	–	0,6	57	–	0,6	0,3	40	45	20	IR 40×45×20
	14	9	45	60,5	–	66,5	0,6	57	60,5	0,6	0,3	40	45	20	IR 40×45×20
50	14	10	50	70	70	–	0,6	62	–	0,6	0,3	45	50	25	IR 45×50×25
	14	10	50	65,5	–	71,5	0,6	62	65,5	0,6	0,3	45	50	25	IR 45×50×25
60	17	12	60	85	85	–	1	75	–	1	1	50	60	25	IR 50×60×25
	17	12	60	80,5	–	86,5	1	75	80,5	1	1	50	60	25	IR 50×60×25
70	18	11	70	95	95	–	1	85	–	1	1	60	70	25	IR 60×70×25
	18	11	70	90,5	–	96,5	1	85	90,5	1	1	60	70	25	IR 60×70×25

[2] For additional information, refer to the section *Needle roller bearing inner rings*, starting on **page 196**.

Needle roller / cylindrical roller thrust bearings

Needle roller / cylindrical roller thrust bearings combine a radial needle roller bearing and a cylindrical roller thrust bearing based on the 811 series. SKF supplies these bearings in the following two series:

- NKXR series (→ **fig. 19**), cylindrical roller thrust bearing is separable
- NKXR .. Z series (→ **fig. 20**), non-separable bearing

These bearings are supplied without an inner ring. For applications where it is not possible to harden and grind the shaft, the bearings can be combined with an inner ring (→ **fig. 21**). Appropriate inner rings are listed in the product tables and can be ordered separately.

Needle roller / cylindrical roller thrust bearings, NKXR series

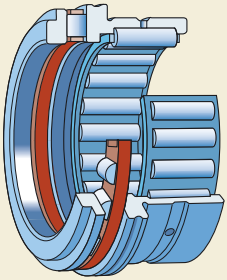
SKF needle roller / cylindrical roller thrust bearings in the NKXR series (→ **fig. 19**) are separable. Both the cylindrical roller and cage thrust assembly and shaft washer can be mounted separately from the rest of the bearing.

Needle roller / cylindrical roller thrust bearings, NKXR .. Z series

SKF needle roller / cylindrical roller thrust bearings in the NKXR .. Z series (→ **fig. 20**) are non-separable. They have a stamped steel cover that extends over the shaft washer of the cylindrical roller thrust bearing. It is firmly attached to the housing washer that is integral to the needle roller bearing outer ring. The cover makes these bearings non-separable. SKF supplies the cylindrical roller thrust bearing in this series filled, as standard, with a high-quality grease that has good rust inhibiting properties. The cover, which has no lubrication holes, forms a gap-type seal with the shaft washer to retain the grease in the bearing.

Fig. 19

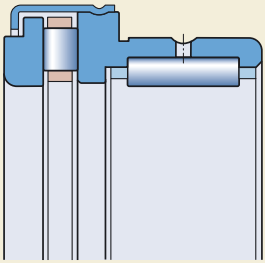
Needle roller / cylindrical roller thrust bearing



NKXR series

Fig. 20

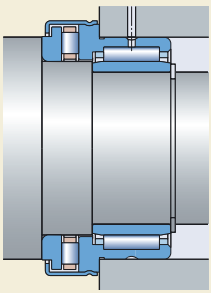
Needle roller / cylindrical roller thrust bearing



NKXR .. Z series

Fig. 21

Needle roller / cylindrical roller thrust bearing, NKXR .. Z series, combined with an inner ring



Dimensions

The boundary dimensions of the single direction needle roller / cylindrical roller thrust bearings are in accordance with DIN 5429-1:2005-08.

Tolerances

SKF needle roller / cylindrical roller thrust bearings are manufactured to the tolerances and tolerance classes listed in **table 3**. The radial runout values are in accordance with ISO 492:2002 and the axial runout values are in accordance with Normal tolerance class of ISO 199:2005.

The values for the deviations from the nominal diameter of the ISO tolerance classes F6 and E8 in **table 3** are listed in **table 4**.

Shaft and housing tolerances

SKF recommends machining the shaft seat for needle roller / cylindrical roller thrust bearings to a k5 tolerance class for bearings with or without an inner ring.

For the housing bore seat, SKF recommends a K6 tolerance class. For stiff bearing arrangements, SKF recommends an M6 housing bore tolerance class.

In addition to their interference fit on the shaft and in the housing, the bearing rings must be axially located by a shaft shoulder or locating ring.

Internal clearance

SKF needle roller / cylindrical roller thrust bearings combined with the appropriate inner ring, as listed in the product tables, have Normal radial internal clearance as standard. The clearance values are listed in **table 7** on **page 42** and are in accordance with ISO 5753:1991. They are valid for unmounted bearings under zero measuring load.

The radial internal clearance for SKF needle roller / cylindrical roller thrust bearings without an inner ring depends on the shaft tolerance. If the recommended k5 shaft tolerance class is applied, the tolerance for the inside diameter F_w will provide an internal clearance that is slightly less than the Normal radial internal clearance.

Table 3

Needle roller / cylindrical roller thrust bearing tolerances

Dimension[1]		Tolerance, tolerance class
Outside diameter	D	Normal, ISO 492:1994
Inside diameter of needle roller complement	F_w	F6
Bore diameter	d	E8
Width	C	0/–0,25 mm
Width	C_1	0/–0,20 mm

[1] Refer to the illustrations in the product table on **page 192**

Table 4

ISO tolerance classes

Nominal diameter over	incl.	**E8** Deviations high	low	**F6** Deviations high	low
mm		µm		µm	
6	**10**	+47	+25	+22	+13
10	**18**	+59	+32	+27	+16
18	**30**	+73	+40	+33	+20
30	**50**	+89	+50	+41	+25
50	**80**	+106	+60	+49	+30

Misalignment

Needle roller / cylindrical roller thrust bearings cannot accommodate any angular misalignment of the shaft relative to the housing, or between the axial support surfaces on the shaft or in the housing.

Cages

The radial needle roller bearing is fitted as standard with a machined steel cage (→ **fig. 4**, **page 172**) or a sheet steel cage (→ **fig. 5**, **page 172**).

The cage that retains the rollers of the cylindrical roller thrust bearing is made of glass fibre reinforced polyamide 66 (→ **fig. 22**).

Note

Needle roller / cylindrical roller thrust bearings should not be operated at temperatures above 120 °C.

The lubricants generally used for rolling bearings do not have a detrimental effect on cage properties. Exceptions are a few synthetic oils and greases with a synthetic oil base and lubricants containing a high proportion of EP additives when used at high temperatures.

For detailed information about the temperature resistance and the applicability of cages, refer to the section *Cage materials*, starting on **page 44**.

Lubrication

To promote efficient lubrication, SKF needle roller / cylindrical roller thrust bearings have an annular groove with lubrication holes in the outer ring of the needle roller bearing.

The shielded thrust bearing of needle roller / cylindrical roller thrust bearings, in the NKXR .. Z series, is filled at the factory with a high-quality grease with good corrosion inhibiting properties. SKF recommends SKF LGWA 2 grease for relubrication. For additional information about greases, refer to the section *Lubrication*, starting on **page 52**.

Bearings in the NKXR series, without the designation suffix Z, should be oil lubricated whenever possible, as oil facilitates an adequate supply of lubricant to the bearing.

Relubrication intervals for the needle roller bearing and cylindrical roller thrust bearing must be calculated separately. The lower of the two intervals should be used. A calculation is necessary for both oil and grease lubrication.

Fig. 22

Polyamide 66 cage of the cylindrical roller thrust bearing

Design of associated components

The diameter of the support surface for the integral housing washer of needle roller / cylindrical roller thrust bearings must always be at least 0,5 mm larger than the dimension D_1 or D_2 (→ **fig. 23**) to obtain a clearance fit. The values for the diameters D_1 and D_2 are listed in the product table.

Application recommendations

SKF needle roller / cylindrical roller thrust bearings can locate a shaft axially in one direction. For short shafts, where changes in length as a result of thermal expansion are relatively minor, two bearings can be used in a back-to-back (mirrored) arrangement (→ **fig. 24**). In these cases, SKF recommends elastically preloading the cylindrical roller thrust bearings with cup springs (belleville washers). This elastic preload helps to avoid skidding of the rolling elements when one of the thrust bearings is unloaded. Elastic preload also reduces the noise level of the cylindrical roller thrust bearing.

Supplementary designations

The designation suffixes used to identify certain features of SKF needle roller / cylindrical roller thrust bearings are explained in the following.

Z Cylindrical roller thrust bearing with a cover over the outside diameter without lubrication holes. Filled at the factory with a high-quality lithium base NLGI 2 grease.

Fig. 23

Clearance fit for the integral housing washer

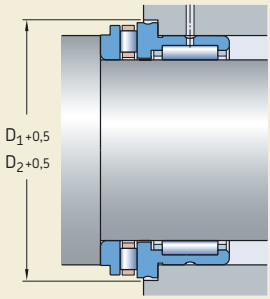
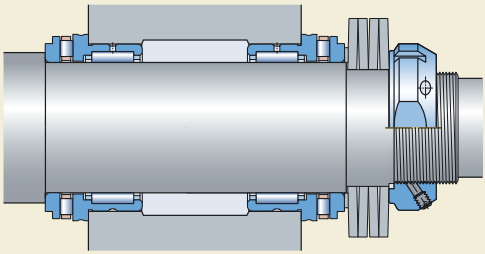
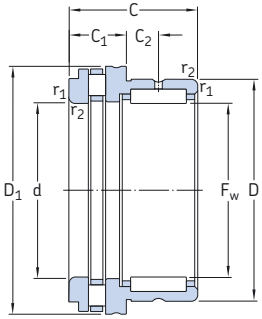


Fig. 24

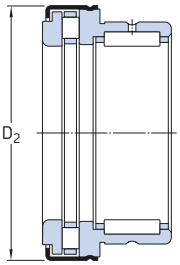
NKXR series, back-to-back arrangement



Needle roller / cylindrical roller thrust bearings
F_w **15 – 50** mm

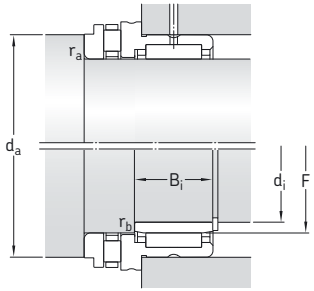


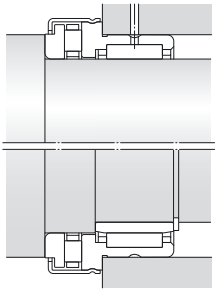
NKXR



NKXR .. Z

Principal dimensions			Basic load ratings radial		axial		Fatigue load limits		Min. load factor	Speed ratings Reference speed	Limiting speed	Mass	Designation
			dynamic	static	dynamic	static	radial	axial					
F_w	D	C	C	C_0	C	C_0	P_u	P_u	A				
mm			kN				kN		–	r/min		kg	–
15	24	23	11,2	14	11,2	27	1,66	2,45	0,058	4 300	8 500	0,042	**NKXR 15**
	24	23	11,2	14	11,2	27	1,66	2,45	0,058	4 300	8 500	0,045	**NKXR 15 Z**
17	26	25	12,3	16,6	12,2	31,5	1,96	2,85	0,079	4 300	8 500	0,05	**NKXR 17**
	26	25	12,3	16,6	12,2	31,5	1,96	2,85	0,079	4 300	8 500	0,053	**NKXR 17 Z**
20	30	30	16,8	26	18,6	48	3,05	4,65	0,18	3 800	7 500	0,08	**NKXR 20**
	30	30	16,8	26	18,6	48	3,05	4,65	0,18	3 800	7 500	0,084	**NKXR 20 Z**
25	37	30	19	32,5	25	69,5	4	6,8	0,39	3 200	6 300	0,12	**NKXR 25**
	37	30	19	32,5	25	69,5	4	6,8	0,39	3 200	6 300	0,13	**NKXR 25 Z**
30	42	30	22,9	39	27	78	4,8	7,65	0,49	3 000	6 000	0,14	**NKXR 30**
	42	30	22,9	39	27	78	4,8	7,65	0,49	3 000	6 000	0,14	**NKXR 30 Z**
35	47	30	24,6	45	29	93	5,6	9,15	0,69	2 800	5 600	0,16	**NKXR 35**
	47	30	24,6	45	29	93	5,6	9,15	0,69	2 800	5 600	0,17	**NKXR 35 Z**
40	52	32	26,4	51	43	137	6,3	13,7	1,5	2 400	5 000	0,2	**NKXR 40**
	52	32	26,4	51	43	137	6,3	13,7	1,5	2 400	5 000	0,21	**NKXR 40 Z**
45	58	32	28,1	57	45	153	7,1	15,3	1,9	2 200	4 500	0,24	**NKXR 45**
	58	32	28,1	57	45	153	7,1	15,3	1,9	2 200	4 500	0,26	**NKXR 45 Z**
50	62	35	38	80	47,5	166	9,65	16,6	2,2	2 200	4 300	0,27	**NKXR 50**
	62	35	38	80	47,5	166	9,65	16,6	2,2	2 200	4 300	0,29	**NKXR 50 Z**





Dimensions							Abutment and fillet dimensions						Appropriate inner ring[1] Designation
F_w	C_1	C_2	d	D_1	D_2	$r_{1,2}$ min	d_a	r_a max	r_b max	d_i	F	B_i	
mm							mm						–
15	9	6,5	15	28	–	0,3	23,7	0,3	0,3	12	15	16	IR 12×15×16
	9	6,5	15	–	29,2	0,3	23,7	0,3	0,3	12	15	16	IR 12×15×16
17	9	8	17	30	–	0,3	25,7	0,3	0,3	14	17	17	IR 14×17×17
	9	8	17	–	31,2	0,3	25,7	0,3	0,3	14	17	17	IR 14×17×17
20	10	10,5	20	35	–	0,3	30,7	0,3	0,3	17	20	20	IR 17×20×20
	10	10,5	20	–	36,2	0,3	30,7	0,3	0,3	17	20	20	IR 17×20×20
25	11	9,5	25	42	–	0,6	37,7	0,6	0,3	20	25	20	IR 20×25×20
	11	9,5	25	–	43,2	0,6	37,7	0,6	0,3	20	25	20	IR 20×25×20
30	11	9,5	30	47	–	0,6	42,7	0,6	0,3	25	30	20	IR 25×30×20
	11	9,5	30	–	48,2	0,6	42,7	0,6	0,3	25	30	20	IR 25×30×20
35	12	9	35	52	–	0,6	47,7	0,6	0,3	30	35	20	IR 30×35×20
	12	9	35	–	53,2	0,6	47,7	0,6	0,3	30	35	20	IR 30×35×20
40	13	10	40	60	–	0,6	55,7	0,6	0,3	35	40	20	IR 35×40×20
	13	10	40	–	61,2	0,6	55,7	0,6	0,3	35	40	20	IR 35×40×20
45	14	9	45	65	–	0,6	60,6	0,6	0,3	40	45	20	IR 40×45×20
	14	9	45	–	66,5	0,6	60,6	0,6	0,3	40	45	20	IR 40×45×20
50	14	10	50	70	–	0,6	65,6	0,6	0,3	45	50	25	IR 45×50×25
	14	10	50	–	71,5	0,6	65,6	0,6	0,3	45	50	25	IR 45×50×25

[1] For additional information, refer to the section *Needle roller bearing inner rings*, starting on **page 196**.


SKF

Needle roller bearing components

Needle roller bearing inner rings

SKF supplies inner rings for needle roller bearings separately. They are primarily used in conjunction with needle roller and cage assemblies and drawn cup needle roller bearings in applications where the shaft cannot be ground and hardened to a suitable raceway tolerance. Extended inner rings are also available. These permit greater axial displacement of the shaft, relative to the housing, compared to standard width inner rings. They also provide an excellent counterface for the lips of contact seals.

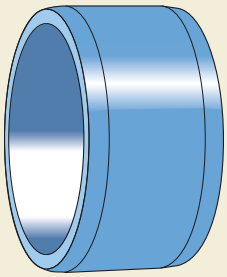
SKF supplies needle roller bearing inner rings in the following two series:

- inner rings in the IR series (→ **fig. 1**), with or without a lubrication hole, with or without machining allowance
- inner rings in the LR series (→ **fig. 2**).

Regardless of whether the ring has an interference or loose fit, it should be located to the shaft by either a shoulder or snap ring to prevent axial movements.

Fig. 1

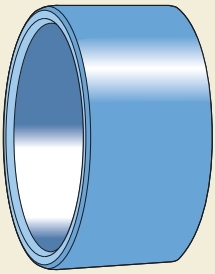
Inner ring



IR series

Fig. 2

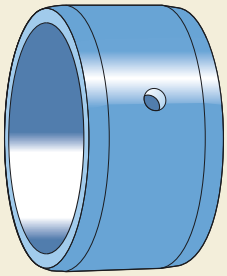
Inner ring



LR series

Fig. 3

Inner ring, with a lubrication hole



IR .. IS1 series

Inner rings in the IR series

Inner rings in the IR series (→ **fig. 1**) are the standard SKF inner rings for needle roller bearings. They are made of carbon chromium bearing steel that has been hardened and ground. The raceway surface, which is precision machined, has a lead-in chamfer on both sides to simplify assembly. The chamfer also protects the sealing lips from damage during the mounting process.

Some sizes of IR inner rings have a lubrication hole (→ **fig. 3**). These inner rings are identified by the designation suffix IS1. Inner rings with additional lubrication holes are available on request.

Tolerances

The bore diameter and the width of IR inner rings are made to Normal tolerances in accordance with ISO 492:2002.

Internal clearance

If the recommended shaft and housing tolerance classes are applied, the tolerances for the inner ring raceway diameter F will provide applications with the following internal clearance:

- a suitable (medium) operational clearance that will reach a value in the range of C2 to C3 radial internal clearance, when combined with SKF drawn cup needle roller bearings. The clearance value depends on the raceway diameter and the operating temperature.
- a Normal radial internal clearance, when combined with SKF needle roller bearings with a machined outer ring. The clearance values are listed in **table 7** on **page 42** and are in accordance with ISO 5753:1991. They are valid for unmounted bearings under zero measuring load.

Raceways with a machining allowance

On request, SKF can supply inner rings in the IR series with a pre-ground raceway and a machining allowance z. These inner rings are identified by the designation suffix VGS. The machining allowance depends on the inner ring raceway diameter and is listed in **table 1**.

Inner rings in the LR series

Inner rings in the LR series (→ **fig. 2**, **page 196**) are made of carbon chromium bearing steel and have been hardened. The bore and outside diameter are ground. The side faces are turned and the edges are smoothed. Therefore, they have larger tolerances than inner rings in the IR series. For applications where the larger run-out and width tolerances are less important, these inner rings can be used to provide a cost-effective bearing arrangement. They are, therefore, often combined with drawn cup needle roller bearings or needle roller and cage assemblies (→ **fig. 4**).

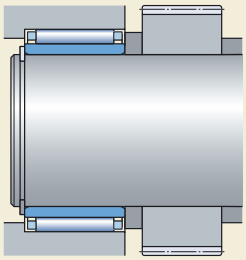
Table 1

Inner ring raceway diameter

Raceway diameter F		Machining allowance z	Preground raceway diameter F_{VGS}
over	incl.		
mm		mm	mm
–	50	0,10	
50	80	0,15	
80	180	0,20	$F_{VGS} = F + z$ h7 tolerance class
180	250	0,25	
250	315	0,30	
315	400	0,35	
400	500	0,40	

Fig. 4

Inner ring, LR series, combined with a needle roller and cage assembly



Tolerances

SKF inner rings in the LR series are manufactured to the following tolerance classes:

- raceway diameter to h6 tolerance class
- width to h12 tolerance class
- bore diameter to K6 tolerance class.

The values for the deviation from the nominal dimension for these tolerances are provided in **table 2**.

Table 2

ISO tolerance classes for LR series inner rings

Nominal diameter over	incl.	h6 Deviations high	low	h12 Deviations high	low	K6 Deviations high	low
mm		µm		µm		µm	
6	**10**	0	–9	0	–150	+2	–7
10	**18**	0	–11	0	–180	+2	–9
18	**30**	0	–13	0	–210	+2	–11
30	**50**	0	–16	0	–250	+3	–13
50	**80**	0	–19	0	–300	+4	–15

Inner ring seats

The seat for an inner ring mounted on a shaft should be in accordance with the following recommendations.

Shaft diameter tolerances

When inner rings are used under conditions of point load and mounted with a loose fit, the seat should be machined to h6 or g6 tolerance class.

When the load rotates, the inner rings should have an interference fit. Sufficient interference can be obtained if the recommended shaft tolerance classes (→ **table 3**, **page 105**) are applied.

Cylindricity

The cylindricity of an inner ring seat should be in accordance with ISO 1101:2004, corresponding to the following IT tolerance classes:

- IT5/2 for inner rings under point load
- IT4/2 for inner rings under rotating load.

Runout

Inner ring shaft abutments should have a run-out corresponding to IT4 tolerance class.

Supplementary designations

The designation suffixes used to identify certain features of SKF needle roller bearing inner rings are explained in the following.

EGS Inner ring with non-directionally ground raceway

IS.. Needle roller bearing with one or more lubricating holes in the inner ring, a figure following indicates the number of holes

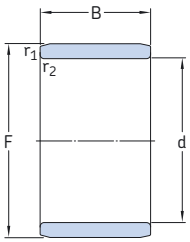
ISR.. Needle roller bearing with an annular groove and one or more lubricating holes in the inner ring, a figure following indicates the number of holes

VGS Inner ring with a pre-ground raceway and a machining allowance

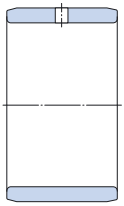
C2 Bearing internal clearance smaller than Normal

C3 Bearing internal clearance greater than Normal

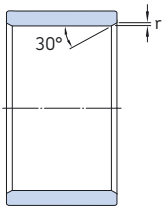
C4 Bearing internal clearance greater than C3



IR



IR .. IS1

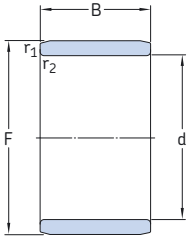


LR

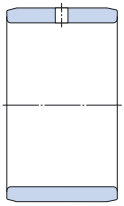
Dimensions				Mass	Designation
d	F	B	r, $r_{1,2}$		
mm				kg	–
5	8	12	0,3	0,0028	**IR 5×8×12**
	8	16	0,3	0,0038	**IR 5×8×16**
6	9	12	0,3	0,0032	**IR 6×9×12**
	9	16	0,3	0,0043	**IR 6×9×16**
	10	10	0,3	0,0037	**IR 6×10×10 IS1**
7	10	10,5	0,3	0,0031	**IR 7×10×10.5**
	10	10,5	0,3	0,0031	**LR 7×10×10.5**
	10	12	0,3	0,0036	**IR 7×10×12**
	10	16	0,3	0,0049	**IR 7×10×16**
8	12	10	0,3	0,0048	**IR 8×12×10 IS1**
	12	10,5	0,3	0,005	**IR 8×12×10.5**
	12	10,5	0,3	0,005	**LR 8×12×10.5**
	12	12,5	0,3	0,0059	**IR 8×12×12.5**
	12	12,5	0,3	0,0059	**LR 8×12×12.5**
9	12	12	0,3	0,0045	**IR 9×12×12**
	12	16	0,3	0,0061	**IR 9×12×16**
10	13	12,5	0,3	0,0052	**IR 10×13×12.5**
	13	12,5	0,3	0,0052	**LR 10×13×12.5**
	14	12	0,3	0,0073	**IR 10×14×12 IS1**
	14	13	0,3	0,0074	**IR 10×14×13**
	14	16	0,3	0,0092	**IR 10×14×16**
	14	20	0,3	0,012	**IR 10×14×20**
12	15	12	0,3	0,0058	**IR 12×15×12**
	15	12,5	0,3	0,0061	**IR 12×15×12.5**
	15	12,5	0,3	0,0061	**LR 12×15×12.5**
	15	16	0,3	0,008	**IR 12×15×16**
	15	16,5	0,3	0,0081	**IR 12×15×16.5**
	15	16,5	0,3	0,0081	**LR 12×15×16.5**
	15	22,5	0,3	0,011	**IR 12×15×22.5**
	15	22,5	0,3	0,011	**LR 12×15×22.5**
	16	12	0,3	0,0079	**IR 12×16×12 IS1**
	16	13	0,3	0,0087	**IR 12×16×13**
	16	16	0,3	0,011	**IR 12×16×16**
	16	20	0,3	0,014	**IR 12×16×20**
	16	22	0,3	0,015	**IR 12×16×22**
14	17	17	0,3	0,01	**IR 14×17×17**
15	18	12,5	0,3	0,0072	**LR 15×18×12.5**
	18	16	0,3	0,0096	**IR 15×18×16**
	18	16,5	0,3	0,0099	**IR 15×18×16.5**
	18	16,5	0,3	0,0099	**LR 15×18×16.5**
	19	16	0,3	0,013	**IR 15×19×16**
	19	20	0,3	0,016	**IR 15×19×20**
	20	12	0,3	0,012	**IR 15×20×12 IS1**
	20	13	0,3	0,014	**IR 15×20×13**
	20	23	0,3	0,024	**IR 15×20×23**
17	20	16	0,3	0,011	**IR 17×20×16**
	20	16,5	0,3	0,011	**IR 17×20×16.5**
	20	16,5	0,3	0,011	**LR 17×20×16.5**
	20	20	0,3	0,014	**IR 17×20×20**
	20	20,5	0,3	0,014	**IR 17×20×20.5**
	20	20,5	0,3	0,014	**LR 17×20×20.5**
	20	30,5	0,3	0,021	**IR 17×20×30.5**
	20	30,5	0,3	0,021	**LR 17×20×30.5**
	21	16	0,3	0,014	**IR 17×21×16**
	21	20	0,3	0,018	**IR 17×21×20**
	22	13	0,3	0,015	**IR 17×22×13**
	22	16	0,3	0,019	**IR 17×22×16**
	22	23	0,3	0,027	**IR 17×22×23**
	24	20	0,3	0,034	**IR 17×24×20**
20	24	16	0,3	0,017	**IR 20×24×16**
	24	20	0,3	0,021	**IR 20×24×20**
	25	12,5	0,3	0,016	**LR 20×25×12.5**
	25	16	0,3	0,021	**IR 20×25×16 IS1**
	25	16,5	0,3	0,022	**LR 20×25×16.5**
	25	17	0,3	0,022	**IR 20×25×17**
	25	20	0,3	0,028	**IR 20×25×20**
	25	20,5	0,3	0,028	**IR 20×25×20.5**
	25	20,5	0,3	0,028	**LR 20×25×20.5**
	25	26,5	0,3	0,036	**IR 20×25×26.5**
	25	26,5	0,3	0,036	**LR 20×25×26.5**
	25	30	0,3	0,041	**IR 20×25×30**
	25	38,5	0,3	0,053	**IR 20×25×38.5**
	25	38,5	0,3	0,053	**LR 20×25×38.5**
	28	20	0,6	0,045	**IR 20×28×20**

Dimensions				Mass	Designation
d	F	B	r, $r_{1,2}$		
mm				kg	–
22	26	16	0,3	0,018	**IR 22×26×16**
	26	20	0,3	0,023	**IR 22×26×20**
	28	17	0,3	0,03	**IR 22×28×17**
	28	20	0,3	0,035	**IR 22×28×20**
	28	20,5	0,3	0,036	**IR 22×28×20.5**
	28	20,5	0,3	0,036	**LR 22×28×20.5**
	28	30	0,3	0,054	**IR 22×28×30**
25	29	20	0,3	0,026	**IR 25×29×20**
	29	30	0,3	0,039	**IR 25×29×30**
	30	12,5	0,3	0,02	**LR 25×30×12.5**
	30	16	0,3	0,026	**IR 25×30×16 IS1**
	30	16,5	0,3	0,027	**LR 25×30×16.5**
	30	17	0,3	0,028	**IR 25×30×17**
	30	20	0,3	0,033	**IR 25×30×20**
	30	20,5	0,3	0,034	**IR 25×30×20.5**
	30	20,5	0,3	0,034	**LR 25×30×20.5**
	30	26,5	0,3	0,043	**IR 25×30×26.5**
	30	26,5	0,3	0,043	**LR 25×30×26.5**
	30	30	0,3	0,05	**IR 25×30×30**
	30	32	0,3	0,053	**IR 25×30×32**
	30	38,5	0,3	0,064	**IR 25×30×38.5**
	30	38,5	0,3	0,064	**LR 25×30×38.5**
	32	22	0,6	0,052	**IR 25×32×22**
28	32	17	0,3	0,025	**IR 28×32×17**
	32	20	0,3	0,028	**IR 28×32×20**
	32	30	0,3	0,044	**IR 28×32×30**
30	35	12,5	0,3	0,023	**LR 30×35×12.5**
	35	13	0,3	0,025	**IR 30×35×13**
	35	16	0,3	0,031	**IR 30×35×16**
	35	16,5	0,3	0,031	**LR 30×35×16.5**
	35	17	0,3	0,032	**IR 30×35×17**
	35	20	0,3	0,04	**IR 30×35×20**
	35	20,5	0,3	0,041	**IR 30×35×20.5**
	35	20,5	0,3	0,041	**LR 30×35×20.5**
	35	26	0,3	0,05	**IR 30×35×26**
	35	30	0,3	0,059	**IR 30×35×30**
	37	18	0,6	0,05	**IR 30×37×18**
	37	22	0,6	0,061	**IR 30×37×22**
	38	20	0,6	0,065	**IR 30×38×20 IS1**

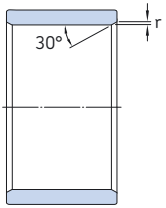
Dimensions				Mass	Designation
d	F	B	r, $r_{1,2}$		
mm				kg	–
32	37	20	0,3	0,042	**IR 32×37×20**
	37	30	0,3	0,063	**IR 32×37×30**
	40	20	0,6	0,068	**IR 32×40×20**
	40	36	0,6	0,12	**IR 32×40×36**
33	37	13	0,3	0,022	**IR 33×37×13**
35	40	12,5	0,3	0,027	**LR 35×40×12.5**
	40	16,5	0,3	0,037	**LR 35×40×16.5**
	40	17	0,3	0,038	**IR 35×40×17**
	40	20	0,3	0,044	**IR 35×40×20**
	40	20,5	0,3	0,046	**IR 35×40×20.5**
	40	20,5	0,3	0,046	**LR 35×40×20.5**
	40	30	0,3	0,068	**IR 35×40×30**
	42	20	0,6	0,064	**IR 35×42×20 IS1**
	42	36	0,6	0,12	**IR 35×42×36**
	43	22	0,6	0,082	**IR 35×43×22**
38	43	20	0,3	0,048	**IR 38×43×20**
	43	30	0,3	0,074	**IR 38×43×30**
40	45	16,5	0,3	0,041	**LR 40×45×16.5**
	45	17	0,3	0,043	**IR 40×45×17**
	45	20	0,3	0,051	**IR 40×45×20**
	45	20,5	0,3	0,053	**IR 40×45×20.5**
	45	20,5	0,3	0,053	**LR 40×45×20.5**
	45	30	0,3	0,077	**IR 40×45×30**
	48	22	0,6	0,092	**IR 40×48×22**
	48	40	0,6	0,17	**IR 40×48×40**
	50	20	1	0,11	**IR 40×50×20 IS1**
	50	22	1	0,12	**IR 40×50×22**
42	47	20	0,3	0,054	**IR 42×47×20**
	47	30	0,3	0,081	**IR 42×47×30**



IR



IR .. IS1



LR

Dimensions				Mass	Designation
d	F	B	r, $r_{1,2}$		
mm				kg	–
45	50	20,5	0,3	0,058	**LR 45×50×20.5**
	50	25	0,6	0,071	**IR 45×50×25**
	50	25,5	0,3	0,074	**IR 45×50×25.5**
	50	25,5	0,3	0,074	**LR 45×50×25.5**
	50	35	0,6	0,1	**IR 45×50×35**
	52	22	0,6	0,089	**IR 45×52×22**
	52	40	0,6	0,16	**IR 45×52×40**
	55	20	1	0,12	**IR 45×55×20 IS1**
	55	22	1	0,13	**IR 45×55×22**
50	55	20	0,6	0,063	**IR 50×55×20 IS1**
	55	20,5	0,6	0,064	**LR 50×55×20.5**
	55	25	0,6	0,078	**IR 50×55×25**
	55	35	0,6	0,11	**IR 50×55×35**
	58	22	0,6	0,12	**IR 50×58×22**
	58	40	0,6	0,21	**IR 50×58×40**
	60	20	1	0,13	**IR 50×60×20 IS1**
	60	25	1	0,16	**IR 50×60×25**
	60	28	1	0,18	**IR 50×60×28**
55	60	25	0,6	0,086	**IR 55×60×25**
	60	35	0,6	0,12	**IR 55×60×35**
	63	25	1	0,14	**IR 55×63×25**
	63	45	1	0,26	**IR 55×63×45**
	65	28	1,1	0,2	**IR 55×65×28**
60	68	25	1	0,15	**IR 60×68×25**
	68	35	0,6	0,21	**IR 60×68×35**
	68	45	1	0,28	**IR 60×68×45**
	70	25	1	0,2	**IR 60×70×25**
	70	28	1,1	0,22	**IR 60×70×28**
65	72	25	1	0,14	**IR 65×72×25**
	72	45	1	0,26	**IR 65×72×45**
	73	25	1	0,16	**IR 65×73×25**
	73	35	1	0,23	**IR 65×73×35**
	75	28	1,1	0,23	**IR 65×75×28**
70	80	25	1	0,22	**IR 70×80×25**
	80	30	1	0,27	**IR 70×80×30**
	80	35	1	0,31	**IR 70×80×35**
	80	54	1	0,49	**IR 70×80×54**

Dimensions				Mass	Designation
d	F	B	r, $r_{1,2}$		
mm				kg	–
75	85	25	1	0,24	**IR 75×85×25**
	85	30	1	0,29	**IR 75×85×30**
	85	35	1	0,34	**IR 75×85×35**
	85	54	1	0,52	**IR 75×85×54**
80	90	25	1	0,25	**IR 80×90×25**
	90	30	1	0,3	**IR 80×90×30**
	90	35	1	0,36	**IR 80×90×35**
	90	54	1	0,55	**IR 80×90×54**
85	95	26	1	0,28	**IR 85×95×26**
	95	36	1	0,39	**IR 85×95×36**
	100	35	1,1	0,58	**IR 85×100×35**
	100	63	1,1	1,05	**IR 85×100×63**
90	100	26	1	0,29	**IR 90×100×26**
	100	30	1	0,34	**IR 90×100×30**
	100	36	1	0,41	**IR 90×100×36**
	105	35	1,1	0,61	**IR 90×105×35**
	105	63	1,1	1,1	**IR 90×105×63**
95	105	26	1	0,31	**IR 95×105×26**
	105	36	1	0,43	**IR 95×105×36**
	110	35	1,1	0,64	**IR 95×110×35**
	110	63	1,1	1,15	**IR 95×110×63**
100	110	30	1,1	0,37	**IR 100×110×30**
	110	40	1,1	0,51	**IR 100×110×40**
	115	40	1,1	0,78	**IR 100×115×40**
110	120	30	1	0,41	**IR 110×120×30**
	125	40	1,1	0,84	**IR 110×125×40**
120	130	30	1	0,44	**IR 120×130×30**
	135	45	1,1	1	**IR 120×135×45**
130	145	35	1,1	0,86	**IR 130×145×35**
	150	50	1,5	1,7	**IR 130×150×50**
140	155	35	1,1	0,92	**IR 140×155×35**
	160	50	1,5	1,8	**IR 140×160×50**

Dimensions				Mass	Designation
d	F	B	r, $r_{1,2}$		
mm				kg	–
150	165	40	1,1	1,1	**IR 150×165×40**
160	175	40	1,1	1,2	**IR 160×175×40**
170	185	45	1,1	1,45	**IR 170×185×45**
180	195	45	1,1	1,5	**IR 180×195×45**
190	210	50	1,5	2,4	**IR 190×210×50**
200	220	50	1,5	2,5	**IR 200×220×50**
220	240	50	1,5	2,75	**IR 220×240×50**
240	265	60	2	4,6	**IR 240×265×60**
260	285	60	2	5	**IR 260×285×60**
280	305	69	2	6,1	**IR 280×305×69**
300	330	80	2,1	9,2	**IR 300×330×80**
320	350	80	2,1	9,8	**IR 320×350×80**
340	370	80	2,1	10	**IR 340×370×80**
360	390	80	2,1	11	**IR 360×390×80**
380	415	100	2,1	17	**IR 380×415×100**

Needle rollers

Needle rollers can be used to make full complement bearing arrangements for slow speed or oscillating applications. These compact bearing arrangements have a high load carrying capacity and are economical, provided the shaft and housing bore can serve as raceways. The cylindrical surface of the rollers is slightly relieved toward the roller ends to prevent damaging edge stresses.

For additional information about surface requirements for raceways, refer to the section *Raceways on shafts and in housings*, starting on **page 50**. For assistance in designing full complement bearing arrangements or to calculate performance data for these bearing arrangements, contact the SKF application engineering service.

Materials

SKF needle rollers are made from carbon chromium steel with a hardness of 58 to 65 HRC and have a precision machined surface.

Tolerances

SKF needle rollers are in accordance with ISO 3096:1996 Grade 2 for flat end needle rollers. SKF supplies needle rollers with the dimensional and form tolerances as listed in **table 3**, where the preferred diameter deviations range from 0 to –7 µm.

The rollers are gauged according to their minimum and maximum deviation from the nominal diameter.

Needle rollers for each gauge are packed separately and the package is marked with the gauge limits, e.g. N/M2 or M2/M4, where M signifies minus and N zero. For a needle roller with a 2 mm nominal diameter and gauge limits M2/M4, the actual diameter is between 1,998 mm and 1,996 mm.

Note

Needle rollers of the same gauge should be used in each bearing arrangement.

A delivery of needle rollers of the same nominal diameter may contain packages of one or more gauges, depending on availability at the time.

Table 3

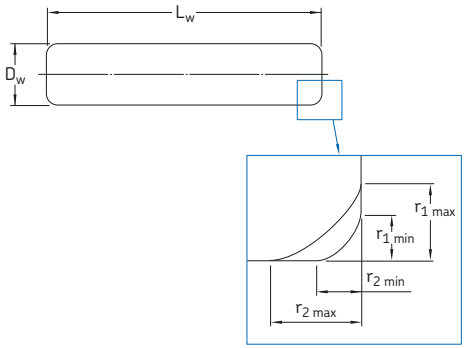
Dimensional and form accuracy of SKF needle rollers, grade G2

Diameter D_w Deviation		Gauge tolerance	Gauge limits	Roundness (max circularity deviation in accordance with ISO 3096)	**Length L_w** Tolerance class
high	low				
µm					–
0	-10	2	0/–2 –1/–3 –2/–4 –3/–5 –4/–6 –5/–7 –6/–8 –7/–9 –8/–10	1	h13

Supplementary designations

The designation suffixes used to identify certain features of SKF needle rollers are explained in the following.

BF Needle roller with flat ends
G2 Needle roller in accordance with ISO 3096:1996 Grade 2
M../M.. Diameter tolerance of needle rollers, e.g. M2/M4 indicates diameter tolerance –2 to –4 µm
N/M.. Diameter tolerance of needle rollers, e.g. N/M2 indicates diameter tolerance 0 to –2 µm



Dimensions					Mass per 1000	Designation
D_w	L_w	$r_{1,2}$ min	r_1 max	r_2 max		
mm					kg	–
1	7,8	0,1	0,4	0,6	0,048	**RN-1×7.8 BF/G2**
1,5	5,8	0,1	0,4	0,6	0,081	**RN-1.5×5.8 BF/G2**
	6,8	0,1	0,4	0,6	0,094	**RN-1.5×6.8 BF/G2**
	7,8	0,1	0,4	0,6	0,108	**RN-1.5×7.8 BF/G2**
	9,8	0,1	0,4	0,6	0,136	**RN-1.5×9.8 BF/G2**
	11,8	0,1	0,4	0,6	0,164	**RN-1.5×11.8 BF/G2**
	13,8	0,1	0,4	0,6	0,191	**RN-1.5×13.8 BF/G2**
2	6,3	0,2	0,6	0,8	0,16	**RN-2×6.3 BF/G2**
	7,8	0,2	0,6	0,8	0,19	**RN-2×7.8 BF/G2**
	9,8	0,2	0,6	0,8	0,24	**RN-2×9.8 BF/G2**
	11,8	0,2	0,6	0,8	0,29	**RN-2×11.8 BF/G2**
	13,8	0,2	0,6	0,8	0,34	**RN-2×13.8 BF/G2**
	15,8	0,2	0,6	0,8	0,39	**RN-2×15.8 BF/G2**
	17,8	0,2	0,6	0,8	0,44	**RN-2×17.8 BF/G2**
	19,8	0,2	0,6	0,8	0,49	**RN-2×19.8 BF/G2**
	21,8	0,2	0,6	0,8	0,54	**RN-2×21.8 BF/G2**
2,5	7,8	0,2	0,6	0,8	0,3	**RN-2.5×7.8 BF/G2**
	9,8	0,2	0,6	0,8	0,38	**RN-2.5×9.8 BF/G2**
	11,8	0,2	0,6	0,8	0,45	**RN-2.5×11.8 BF/G2**
	13,8	0,2	0,6	0,8	0,53	**RN-2.5×13.8 BF/G2**
	15,8	0,2	0,6	0,8	0,61	**RN-2.5×15.8 BF/G2**
	17,8	0,2	0,6	0,8	0,69	**RN-2.5×17.8 BF/G2**
	19,8	0,2	0,6	0,8	0,76	**RN-2.5×19.8 BF/G2**
	21,8	0,2	0,6	0,8	0,84	**RN-2.5×21.8 BF/G2**
	23,8	0,2	0,6	0,8	0,92	**RN-2.5×23.8 BF/G2**
3	9,8	0,2	0,6	0,8	0,54	**RN-3×9.8 BF/G2**
	11,8	0,2	0,6	0,8	0,65	**RN-3×11.8 BF/G2**
	13,8	0,2	0,6	0,8	0,77	**RN-3×13.8 BF/G2**
	15,8	0,2	0,6	0,8	0,88	**RN-3×15.8 BF/G2**
	17,8	0,2	0,6	0,8	0,99	**RN-3×17.8 BF/G2**
	19,8	0,2	0,6	0,8	1,1	**RN-3×19.8 BF/G2**
	21,8	0,2	0,6	0,8	1,21	**RN-3×21.8 BF/G2**
	23,8	0,2	0,6	0,8	1,32	**RN-3×23.8 BF/G2**

Dimensions					Mass per 1000	Designation
D_w	L_w	$r_{1,2}$ min	r_1 max	r_2 max		
mm					kg	–
3,5	11,8	0,3	0,8	1	0,89	**RN-3.5×11.8 BF/G2**
	13,8	0,3	0,8	1	1,04	**RN-3.5×13.8 BF/G2**
	15,8	0,3	0,8	1	1,19	**RN-3.5×15.8 BF/G2**
	17,8	0,3	0,8	1	1,34	**RN-3.5×17.8 BF/G2**
	19,8	0,3	0,8	1	1,5	**RN-3.5×19.8 BF/G2**
	21,8	0,3	0,8	1	1,65	**RN-3.5×21.8 BF/G2**
	29,8	0,3	0,8	1	2,25	**RN-3.5×29.8 BF/G2**
	34,8	0,3	0,8	1	2,63	**RN-3.5×34.8 BF/G2**
4	11,8	0,3	0,8	1	1,16	**RN-4×11.8 BF/G2**
	13,8	0,3	0,8	1	1,36	**RN-4×13.8 BF/G2**
	15,8	0,3	0,8	1	1,56	**RN-4×15.8 BF/G2**
	17,8	0,3	0,8	1	1,76	**RN-4×17.8 BF/G2**
	19,8	0,3	0,8	1	1,95	**RN-4×19.8 BF/G2**
	21,8	0,3	0,8	1	2,15	**RN-4×21.8 BF/G2**
	23,8	0,3	0,8	1	2,35	**RN-4×23.8 BF/G2**
	25,8	0,3	0,8	1	2,55	**RN-4×25.8 BF/G2**
	27,8	0,3	0,8	1	2,74	**RN-4×27.8 BF/G2**
	29,8	0,3	0,8	1	2,94	**RN-4×29.8 BF/G2**
	34,8	0,3	0,8	1	3,43	**RN-4×34.8 BF/G2**
	39,8	0,3	0,8	1	3,93	**RN-4×39.8 BF/G2**
5	15,8	0,3	0,8	1	2,44	**RN-5×15.8 BF/G2**
	19,8	0,3	0,8	1	3,05	**RN-5×19.8 BF/G2**
	21,8	0,3	0,8	1	3,36	**RN-5×21.8 BF/G2**
	23,8	0,3	0,8	1	3,67	**RN-5×23.8 BF/G2**
	25,8	0,3	0,8	1	3,98	**RN-5×25.8 BF/G2**
	27,8	0,3	0,8	1	4,28	**RN-5×27.8 BF/G2**
	29,8	0,3	0,8	1	4,59	**RN-5×29.8 BF/G2**
	34,8	0,3	0,8	1	5,36	**RN-5×34.8 BF/G2**
	39,8	0,3	0,8	1	6,13	**RN-5×39.8 BF/G2**
6	17,8	0,3	0,8	1	3,95	**RN-6×17.8 BF/G2**

Radial shaft seals with a low cross sectional height

It is not always easy to find commercially available radial shaft seals for bearing arrangements that incorporate needle roller bearings because of their very low cross section. As a result, SKF offers a wide assortment of special low cross section radial shaft seals to fit virtually all of these bearing arrangements. These contact seals are designed without garter springs and available in two designs:

- the G design with a single lip
- the SD design with a double lip

G design radial shaft seals

G design radial shaft seals are made of acrylonitrile-butadiene rubber (NBR). The seals for shaft diameters ≥ 8 mm (→ **fig. 5**) are reinforced with sheet steel. The rubber outside diameter enhances the seal around the housing bore and reduces the risk of damage to the seal and housing during installation and removal.

To attain an adequate degree of rigidity for seals for shaft diameters ≤ 7 mm (→ **fig. 6**), the rubber material is metal cased. These seals are identified by the designation suffix S.

If the seal is to be used primarily for lubricant retention, it should be mounted with the lip facing inward. If the primary purpose of the seal is to exclude contaminants, the lip should face outward, away from the bearing (→ **fig. 7**).

For information about the chemical resistance of acrylonitrile-butadiene rubber (NBR), refer to the *SKF Interactive Engineering Catalogue* (section *Chemical resistance*).

SD design radial shaft seals

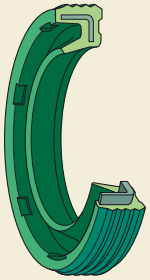
SD design radial shaft seals (→ **fig. 8**) have a primary seal lip and an auxiliary dust lip. The lips are made of polyurethane (AU) and the reinforcement ring is made of polyamide (PA) instead of metal.

The auxiliary lip is the smaller of the two lips and designed with zero lip/shaft interference to avoid additional friction, heat and energy losses.

The primary seal lip, i.e. the larger of the two lips, is a contact seal and should always point toward the medium that is to be sealed. Therefore, if the primarily function is protection

Fig. 5

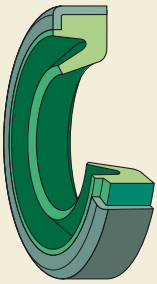
Radial shaft seal



G series ($d_1 \geq 8$ mm)

Fig. 6

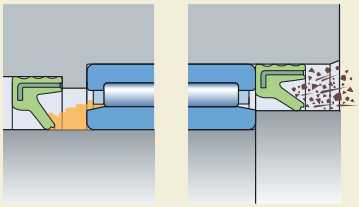
Radial shaft seal



G .. S series ($d_1 \leq 7$ mm)

Fig. 7

Needle roller bearing with machined rings with an external G design seal



Primary lip facing inward

Primary lip facing outward

against ingress of contaminants, the primary lip should face outward. The auxiliary lip will contribute to retain lubricant in the bearing arrangement.

In applications whereas the main purpose is retaining the lubricant, the primary lip should face inward, toward the bearing.

The cavity between the two lips should be filled with a grease that is compatible with the lubricant used in the application. This will provide additional protection and prevent the seal from dry running.

SD seals are resistant to lubricating oils, even those containing small quantities of EP additives, and also to mineral oil based greases.

Depending on the counterface of the shaft, SD seals can also be used as wiper seals for linear applications with speeds up to 3 m/s.

Design of associated components

Shaft requirements

To achieve a reliable seal and sufficiently long service life, the surface of the seal counterface should have a hardness of at least 55 HRC or 600 HV. The surface roughness of the counterface on the shaft of rotary applications should lie between R_a 0,2 and 0,8 µm, if the maximum permissible circumferential speeds are to be used. For linear applications, the maximum permissible roughness of the counterface is R_a 0,3 µm.

The diameter of the shaft at the counterface should be machined to g7 up to k7 tolerance classes. The shaft end should have a 15 to 30° lead-in chamfer to prevent damage to the seal lips during mounting. Appropriate minimum dimensions for lead-in chamfers (→ **fig. 9**) are:

- h_1 = 0,3 mm for seals with an outside diameter $d_2 \leq 30$ mm
- h_1 = 0,5 mm for seals with an outside diameter $d_2 > 30$ mm

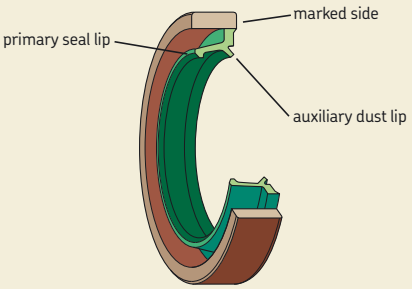
Housing requirements

The housing bore tolerance classes normally recommended for needle roller bearings will provide a sufficient interference fit for the seals.

In general, these seals can be fitted into housing bores machined to G7 up to R7 tolerance class.

Fig. 8

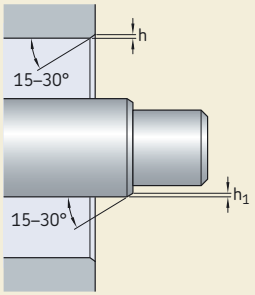
Radial shaft seal



SD design

Fig. 9

Lead-in chamfers for shafts and housings



No additional axial location of the seal will be needed.

To simplify mounting, the housing bore should have a 15 to 30° lead-in chamfer. Appropriate minimum dimensions for lead-in chamfers (→ **fig. 9**) are:

- h = 0,3 mm for seals with an outside diameter $d_2 \leq 30$ mm
- h = 0,01 d_2 mm for seals with an outside diameter $d_2 > 30$ mm

Speeds

If the recommendations under *Design of associated components* are adhered to, the permissible circumferential speed is 10 m/s for both seal designs. To convert circumferential speed to rotational speed, use

$$n = \frac{d \pi 1\,000}{v\,60}$$

where
n = rotational speed [r/min]
d = shaft diameter [mm]
v = circumferential speed [m/s]

Operating temperature range

The permissible operating temperature range for

- G design seals is –30 to +110 °C (–20 to +230 °F)
- SD design seals is –30 to +100 °C (–20 to +210 °F).

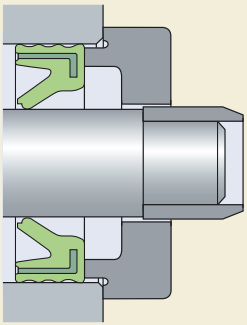
These material related temperature ranges can only be considered as rough guidelines as the influence from the medium in which the seal is working must also be considered.

Mounting instructions

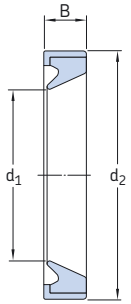
The seals should be mounted concentric and perpendicular to the shaft. A suitable mounting tool (**→ fig. 10**) should be used to prevent the seal from skewing. The outside diameter of G design seals should be lightly oiled to ease installation. If the shaft ends are not chamfered or rounded, a mounting sleeve should be used to prevent damage to the seal lip.

Fig. 10

Mounting tool



Radial shaft seals with a low cross sectional height
d **4 – 70** mm



G
(d_1 ≤ 7 mm)

G
(d_1 ≥ 8 mm)

SD

Dimensions			Mass per 100	Designation
d_1	d_2	b		
mm			kg	–
4	8	2	0,018	**G 4×8×2 S**
5	9	2	0,019	**G 5×9×2 S**
	10	2	0,022	**G 5×10×2 S**
6	10	2	0,021	**G 6×10×2 S**
	12	2	0,038	**G 6×12×2 S**
7	11	2	0,025	**G 7×11×2 S**
	14	2	0,052	**G 7×14×2 S**
8	12	3	0,041	**G 8×12×3**
	15	3	0,065	**G 8×15×3**
	15	3	0,04	**SD 8×15×3**
9	13	3	0,044	**G 9×13×3**
	16	3	0,069	**G 9×16×3**
10	14	3	0,05	**G 10×14×3**
	17	3	0,09	**G 10×17×3**
	17	3	0,044	**SD 10×17×3**
12	16	3	0,06	**G 12×16×3**
	18	3	0,09	**G 12×18×3**
	18	3	0,05	**SD 12×18×3**
	19	3	0,1	**G 12×19×3**
	19	3	0,06	**SD 12×19×3**
13	19	3	0,09	**G 13×19×3**
14	20	3	0,1	**G 14×20×3**
	20	3	0,05	**SD 14×20×3**
	21	3	0,11	**G 14×21×3**
	22	3	0,13	**G 14×22×3**
	22	3	0,07	**SD 14×22×3**
15	21	3	0,1	**G 15×21×3**
	21	3	0,05	**SD 15×21×3**
	23	3	0,13	**G 15×23×3**
	23	3	0,07	**SD 15×23×3**
16	22	3	0,13	**G 16×22×3**
	22	3	0,06	**SD 16×22×3**
	24	3	0,13	**G 16×24×3**
	24	3	0,08	**SD 16×24×3**
	25	3	0,16	**G 16×25×3**
17	23	3	0,13	**G 17×23×3**
	23	3	0,06	**SD 17×23×3**
	25	3	0,15	**G 17×25×3**
	25	3	0,08	**SD 17×25×3**
18	24	3	0,12	**G 18×24×3**
	24	3	0,06	**SD 18×24×3**
	26	4	0,18	**G 18×26×4**
	26	4	0,11	**SD 18×26×4**
19	27	4	0,2	**G 19×27×4**
	27	4	0,11	**SD 19×27×4**
20	26	4	0,18	**G 20×26×4**
	26	4	0,08	**SD 20×26×4**
	28	4	0,21	**G 20×28×4**
	28	4	0,11	**SD 20×28×4**
21	29	4	0,22	**G 21×29×4**
22	28	4	0,18	**G 22×28×4**
	28	4	0,09	**SD 22×28×4**
	30	4	0,22	**G 22×30×4**
	30	4	0,13	**SD 22×30×4**
24	32	4	0,25	**G 24×32×4**
25	32	4	0,23	**G 25×32×4**
	32	4	0,13	**SD 25×32×4**
	33	4	0,25	**G 25×33×4**
	33	4	0,13	**SD 25×33×4**
	35	4	0,26	**G 25×35×4**
	35	4	0,19	**SD 25×35×4**

Dimensions			Mass per 100	Designation
d_1	d_2	b		
mm			kg	–
26	34	4	0,26	**G 26×34×4**
	34	4	0,14	**SD 26×34×4**
28	35	4	0,24	**G 28×35×4**
	35	4	0,13	**SD 28×35×4**
	37	4	0,31	**G 28×37×4**
29	38	4	0,32	**G 29×38×4**
30	37	4	0,27	**G 30×37×4**
	37	4	0,13	**SD 30×37×4**
	40	4	0,36	**G 30×40×4**
	40	4	0,21	**SD 30×40×4**
32	42	4	0,37	**G 32×42×4**
	42	4	0,24	**SD 32×42×4**
	45	4	0,51	**G 32×45×4**
35	42	4	0,3	**G 35×42×4**
	42	4	0,15	**SD 35×42×4**
	45	4	0,41	**G 35×45×4**
	45	4	0,25	**SD 35×45×4**
37	47	4	0,4	**G 37×47×4**
	47	4	0,27	**SD 37×47×4**
38	48	4	0,44	**G 38×48×4**
	48	4	0,28	**SD 38×48×4**
40	47	4	0,33	**G 40×47×4**
	47	4	0,17	**SD 40×47×4**
	50	4	0,46	**G 40×50×4**
	50	4	0,29	**SD 40×50×4**
	52	5	0,48	**G 40×52×5**
	52	5	0,45	**SD 40×52×5**
42	52	4	0,47	**G 42×52×4**
	52	4	0,3	**SD 42×52×4**
43	53	4	0,48	**G 43×53×4**

Dimensions			Mass per 100	Designation
d_1	d_2	b		
mm			kg	–
45	52	4	0,38	**G 45×52×4**
	52	4	0,19	**SD 45×52×4**
	55	4	0,52	**G 45×55×4**
	55	4	0,32	**SD 45×55×4**
50	58	4	0,45	**G 50×58×4**
	58	4	0,24	**SD 50×58×4**
	62	5	1,05	**G 50×62×5**
	62	5	0,55	**SD 50×62×5**
55	63	5	0,71	**G 55×63×5**
70	78	5	0,9	**G 70×78×5**


SKF

Track runner bearings

Support rollers

SKF support rollers have an internal design very similar to that of a needle or cylindrical roller bearing. They are characterized by a thick walled outer ring that enables them to accommodate shock loads while reducing distortion and bending stresses. The outer ring running surface is crowned as standard (→ **page 220**). However, support rollers with a cylindrical (flat) running surface are available for certain applications. These pre-greased, ready-to-mount units are suitable for all types of cam drives, tracks and conveyor systems.

SKF support rollers are available:

- without flange rings (→ **fig. 1**)
- with flange rings (→ **fig. 2**)

Support rollers without flange rings

SKF supplies support rollers without flange rings in two designs and variants:

- with or without an inner ring
- open or sealed with two integral flanges in the outer ring

SKF support rollers without flange rings are designed for applications where associated components limit axial movement of the outer ring.

Support rollers with an inner ring have a slightly extended inner ring to enable the necessary axial movement.

Support rollers without an inner ring are intended for arrangements where the pin or shaft can be hardened and ground.

Fig. 1

Support roller without flange rings

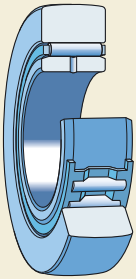
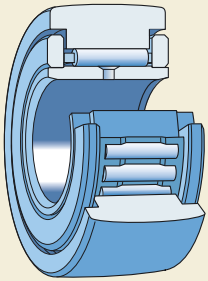


Fig. 2

Support roller with flange rings



STO and RSTO design support rollers

STO design support rollers (→ **fig. 3**) have an inner ring, while RSTO design support rollers (→ **fig. 4**) do not have an inner ring. Both designs are available only as open (without seals) support rollers, making it possible to mount each component separately. However, needle roller and cage assemblies and support roller outer rings must always be kept together as supplied.

NA 22...2RS and RNA 22...2RS design support rollers

NA 22...2RS design support rollers (→ **fig. 5**) have an inner ring that can be mounted individually. RNA 22...2RS design support rollers (→ **fig. 6**) do not have an inner ring and are intended for arrangements where the pin or shaft can be hardened and ground.

The needle roller and cage assembly is axially guided between two integral flanges in the outer ring and forms a non-separable unit with the outer ring.

Both of these designs are fitted with contact seals made of oil and wear-resistant acrylonitrile-butadiene rubber (NBR). They are designed for applications where contamination is light to moderate and where moisture or water spray cannot be avoided.

Fig. 3

STO design support roller

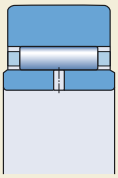


Fig. 4

RSTO design support roller

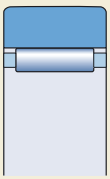


Fig. 5

NA 22...2RS design support roller

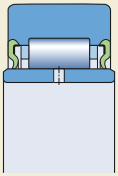
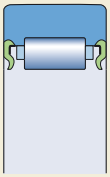


Fig. 6

RNA 22...2RS design support roller



Support rollers with flange rings

Support rollers with flange rings are non-separable units and are available in different designs and variants:

- with gap-type, labyrinth, polyamide or rubber seals
- with needle or cylindrical rollers
- with one or two rows of rollers
- with a cage-guided or a full complement roller set

Support rollers with flange rings are well suited for applications where lateral (thrust) surfaces are not available (→ **fig. 7**). Thrust forces, induced when shafts are not horizontal or when there is misalignment, are accommodated by the flange rings.

NATR design support rollers

NATR design support rollers (→ **fig. 8**) are fitted with a needle roller and cage assembly. The outer ring is guided axially by pressed-on flange rings. The narrow gap between the flange rings and the outer ring serves as a gap-type seal.

NATV design support rollers

NATV design support rollers (→ **fig. 9**) are similar to the NATR design, except that they have a full complement of needle rollers. Therefore, NATV support rollers can accommodate heavier radial loads than NATR support rollers. However, because of the kinematic behaviour of the needle rollers, they are not able to operate at the same high speeds and require more frequent relubrication.

Fig. 7

Application of support roller with flange rings

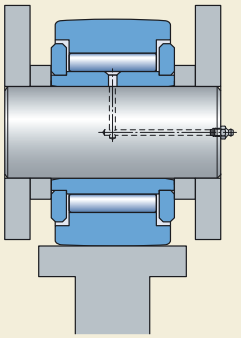


Fig. 8

NATR design support roller

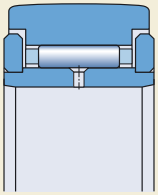
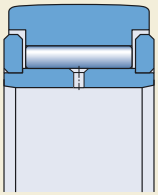


Fig. 9

NATV design support roller



NATR and NATV design support rollers, designation suffix PPA

NATR and NATV design support rollers with the designation suffix PPA have axial sliding rings made of polyamide 66 (→ **fig. 10**). In the radial direction, the sliding ring forms a narrow labyrinth seal with the outer ring to protect against coarse contaminants. In the axial direction, the sliding ring serves as a contact seal to reliably retain grease in the bearing. This improves the lubrication conditions in the bearing, keeps friction and heat low, and extends grease service life.

NUTR .. A design support rollers

NUTR .. A design support rollers (→ **fig. 11**) are based on double row full complement cylindrical roller bearings. The outer ring has two integral flanges to axially guide the roller complements. A loose flange ring on both sides of the inner ring provides axial guidance for the outer ring via the roller complements. This enables NUTR .. A design support rollers to accommodate axial loads that occur when operating in a tilted or inclined position and to operate at relatively high speeds.

Sheet metal angle rings that are pressed into the outer ring and extend over the flange rings hold the bearing components together and form effective labyrinth seals.

If heavy shock loads can be expected, support rollers with a reinforced outer ring should be used. These are identified by a four or five-digit number instead of a two-digit number in the bearing designation, e.g. NUTR 50110 A. If heavy shock loads can be expected, support rollers with a reinforced outer ring should be used. These are identified by a four- or five-digit number instead of a two-digit number in the bearing designation, e.g. NUTR 50110 A.

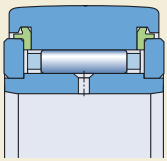
PWTR ...2RS design support rollers

PWTR ...2RS design support rollers (→ **fig. 12**) have a contact seal of oil and wear-resistant acrylonitrile-butadiene rubber (NBR) on both sides. The seals make these rollers particularly suitable for operation under arduous conditions. The seals, which are integral with the sheet metal angle rings, press against the flange rings. The angle rings are pressed in the outer ring and extend over the flange rings to hold the components together.

Three integral flanges in the outer ring axially guide the two full complement roller sets sep-

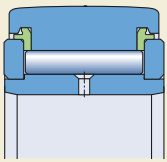
Fig. 10

NATR design support roller, designation suffix PPA



NATR .. PPA series

NATV design support roller, designation suffix PPA



NATV .. PPA series

Fig. 11

NUTR .. A design support roller

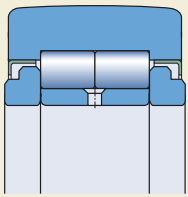
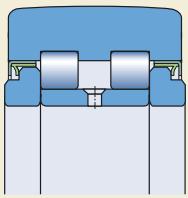


Fig. 12

PWTR ...2RS design support roller



arately, to minimize friction in the support roller, thereby reducing the amount of heat generated by the bearing. A loose flange ring on both sides of the inner ring provides axial guidance for the outer ring via the roller complements. This enables the support rollers to accommodate axial loads that occur when operating in a tilted or inclined position.

The large space between the two rows of rollers enables a large quantity of grease to be incorporated. The large grease fill and efficient sealing method make it possible to operate PWTR ...2RS design support rollers for much longer periods between maintenance intervals than was previously possible, even under contaminated conditions. If heavy shock loads can be expected, SKF recommends to applying support rollers with a reinforced outer ring. These are identified by a four- or five-digit number instead of a two-digit number in the bearing designation, e.g. PWTR 50110.2RS.

NNTR ...2ZL design support rollers

NNTR ...2ZL design support rollers have a full complement of rollers (→ **fig. 13**) and can accommodate very heavy radial loads.

NNTR ...2ZL design support rollers incorporate a lamellar seal on both sides. These seals are inserted into recesses in the shoulders of the flange rings and the outer ring and provide support to hold the bearing together. Three integral flanges in the outer ring axially guide the two rows of full complement rollers separately to minimize friction in the support roller, thereby reducing the amount of heat generated by the bearing. Two loose flange rings guide the outer ring axially via the roller complements. This enables the support rollers to accommodate the relatively heavy constant axial loads that occur when support rollers operate in an inclined position.

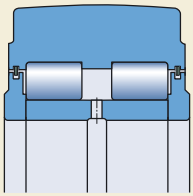
Profile of the outer ring running surface

Crowned outer ring running surface

SKF supplies support rollers, as standard, with a crowned outer ring running surface. This surface provides good load distribution during operation when the bearing is in a tilted or inclined position.

Fig. 13

NNTR ...2ZL design support roller



The crowned running surface has a radius of 500 mm for the following support roller designs:

- STO and RSTO designs
- NA 22...2RS and RNA 22...2RS designs
- NATR and NATV without designation suffix

SKF also supplies support rollers with an improved crowned profile of the outer ring running surface. The modified line contact provides even better load distribution than the standard radius. In practice, this modified line contact provides a higher degree of stiffness while reducing wear between the outer ring running surface and the track.

The following support roller designs have an improved crowned profile:

- NATR and NATV designs, designation suffix PPA
- NUTR .. A design
- PWTR ...2RS design

The crowned running surface of NNTR...2ZL design support rollers depends on the outside diameter of the bearing:

- a 10 000 mm radius for an outside diameter ≤ 260 mm
- a 15 000 mm radius for an outside diameter ≥ 290 mm

Cylindrical outer ring running surface

SKF recommends support rollers with a cylindrical (flat) outer ring running surface for applications requiring a high degree of stiffness and when operating in a tilted or inclined position can be avoided. They are identified by the designation suffix X. These support rollers are dimensionally interchangeable with standard profile support rollers. For additional information, contact the SKF application engineering service.

Dimensions

The dimensions of (R)NA 22...2RS design support rollers are in accordance with ISO 15:1998. The dimensions of NATR, NATV, NUTR .. A and PWTR ...2RS design support rollers, where standardized, are in accordance with ISO 7063:2003 and ANSI/ABMA Standard 18.1-1982.

Tolerances

SKF supplies support rollers to Normal tolerances in accordance with ISO 492:2002. Exceptions are:

- the tolerance for the outside diameter D of the running surface with a crowned profile, 0/–0,050 mm
- the tolerance for the outside diameter D of the running surface of the NNTR ...2ZL design support rollers, h10 tolerance class
- the tolerance for the width B of NNTR design support rollers, 0/-0,50 mm
- the tolerance for the width B of NATR, NATV, NUTR .. A and PWTR ...2RS design support rollers , h12 tolerance class
- the tolerance for the circularity of the inner rings of NATR and NATV design support rollers

The inside diameter F_w of the roller sets for RSTO and RNA 22...2RS design support rollers lies within the limits of F6 tolerance class.

The limits for h10, h12 and F6 tolerance classes are listed in **table 1**.

Table 1

ISO tolerance classes

Nominal dimension over	incl.	h10 Deviations high	low	h12 Deviations high	low	F6 Deviations high	low
mm		µm		µm		µm	
3	**6**	0	–48	0	–120	+18	+10
6	**10**	0	–58	0	–150	+22	+13
10	**18**	0	–70	0	–180	+27	+16
18	**30**	0	–84	0	–210	+33	+20
30	**50**	0	–100	0	–250	+41	+25
50	**80**	0	–120	0	–300	+49	+30
80	**120**	0	–140	0	–350	+58	+36
120	**180**	0	–160	0	–400	+68	+43
180	**250**	0	–185	0	–460	+79	+50
250	**315**	0	–210	0	–520	+88	+56

Internal clearance

SKF supplies support rollers with a C2 radial internal clearance as standard. However, STO and NA 22...2RS design support rollers without a flange ring have Normal radial internal clearance.

The clearance values are listed in **table 7** on **page 42** and are in accordance with ISO 5753:1991. They are valid for unmounted support rollers under zero measuring load.

Load carrying capacity

Compared to a typical rolling bearing, where the outer ring is fully supported in a housing, a support roller has only a small contact area between its outside diameter and the track. The actual contact area depends on the applied radial load and whether the running surface is crowned or cylindrical (flat). The deformation of the outer ring, caused by this limited contact, alters the force distribution in the bearing, which affects load carrying capacity. The basic load ratings listed in the product tables take this into account.

The ability to accommodate dynamic loads depends on the requisite life, but it is also important to consider the strength of the outer

ring. Therefore, the value of the maximum dynamic radial load F_r should not be exceeded.

The permissible static load for a support roller is determined by the smaller of the values F_{0r} and C_0. If requirements for smooth running are below normal, the static load may exceed C_0, but should never exceed the maximum permissible static radial load F_{0r}.

Cages

(R)STO, (R)NA 22...2RS and NATR design support rollers are fitted with a steel cage (→ **fig. 14**), except for (R)STO design support rollers with the designation suffix TN. These support rollers have a cage made of glass fibre reinforced polyamide 66 (→ **fig. 15**) that can operate at temperatures up to 120 °C.

For additional information about the temperature resistance and the applicability of cages, refer to the section *Cage materials*, starting on **page 44**.

Permissible operating temperature

Generally, the permissible temperature range for support rollers is –30 to +140 °C.

Exceptions due to the seal and cage material are:

- –30 to +120 °C for (R)NA 22...2RS and PWTR ...2RS designs and the (R)STO design, designation suffix TN
- –30 to +100 °C for NATR and NATV designs, designation suffix PPA

Exceptions due to the applied grease must also be taken into account.

For additional information about temperature restrictions, refer to the sections *Cage materials* (→ **page 44**) and *Lubrication* (→ **page 52**).

Lubrication

All support rollers are filled at the factory with a high-quality grease with good corrosion inhibiting properties.

Although SKF support rollers require little maintenance, they must be relubricated to achieve their full service life. SKF recommends relubrication while the initial grease fill still has its full lubricating properties. A lubrication hole is provided in the inner ring so that if suitable ducts are provided in the pin, the support rollers are easy to relubricate. Support rollers used in applications where there are light loads, relatively low speeds and clean surroundings, can operate for long periods before relubrication is required. Support rollers that operate under contaminated and damp conditions at high speeds or at temperatures above +70 °C require frequent relubrication. Full complement NATV and NUTR .. A design support rollers require more frequent relubrication. SKF recommends using SKF LGWA 2 grease for relubrication.

For additional information about greases, refer to the section *Lubrication*, starting on **page 52**.

Fig. 14

Machined steel cage

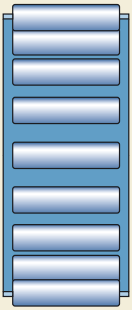
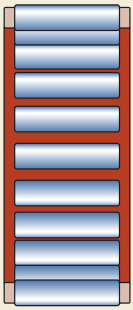


Fig. 15

Polyamide 66 cage



SKF supplies all inner rings for support rollers with one lubrication hole except for inner rings of the NNTR design, which have:

- 3 lubrication holes for a bore diameter ≤ 90 mm
- 6 lubrication holes for a bore diameter ≥ 100 mm

(R)STO design support rollers can be oil or grease lubricated. In applications where oil is used, SKF recommends thoroughly washing the initial grease fill from the bearing prior to operation.

Design of associated components

Axial play

Support rollers with inner rings and flange rings, if included, must be located without axial play (→ **fig. 16**).

Support rollers without an inner ring must have an axial play of 0,2 mm to the support surfaces (→ **fig. 16**).

Support surfaces

The outer ring support surfaces of support rollers without flange rings must be fine turned, free of burrs and clean. Unhardened surfaces should extend to at least half the outer ring side face (→ **fig. 16**) while hardened surfaces may be smaller.

Heavily loaded support rollers with flange rings should be provided with complete support for the flange ring side faces and the support surface should be dimensioned according to the diameter d_1 (→ **fig. 17**).

Pins

Support rollers generally operate under conditions of stationary inner ring load. For this type of load, and if easy displacement of the inner ring is required, the pins should be machined to a g6 tolerance class. The appropriate tolerance for pins for support rollers without an inner ring is a k5 tolerance class. To exploit the full load carrying capacity of the support roller, the raceways on the pins should have the same hardness and surface finish normally found on bearing raceways. For detailed information, refer to the section *Raceways on shafts and in housings*, starting on **page 50**.

Fig. 16

Support roller without flange rings, axial guidance provided by associated components

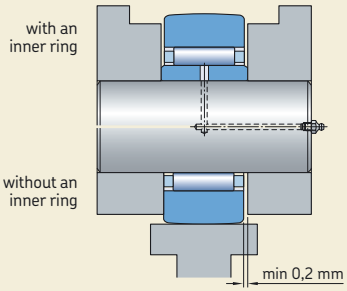
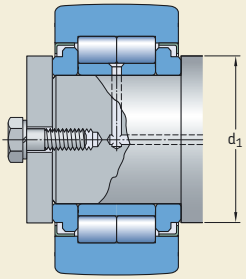


Fig. 17

Support roller with integral flanges in the outer ring, axial guidance provided by loose flange rings



Mounting instructions

SKF recommends positioning the lubrication hole in the unloaded zone of the support roller inner ring.

When mounting the outer ring assembly and inner ring individually, care must be taken not to damage the lips of the seals.

Supplementary designations

The designation suffixes used to identify certain features of SKF support rollers are explained in the following.

.2RS Contact seal of acrylonitrile-butadiene rubber (NBR) on both sides of the support roller

.2ZL Support rollers with a lamellar seal on both sides

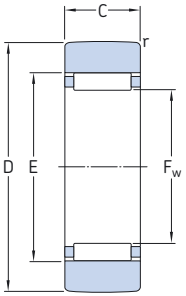
A NUTR design support rollers with an improved crowned profile of the outer ring running surface

PPA NATR or NATV design support rollers with a polyamide 66 axial sliding and sealing ring on both sides. Improved crowned profile of the outer ring running surface.

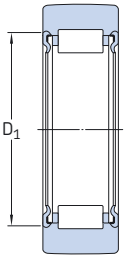
TN Injection moulded cage of glass fibre reinforced polyamide 66

X Cylindrical (flat) profile of the outer ring running surface

Support rollers without flange rings, without an inner ring
D **16 – 90** mm



RSTO

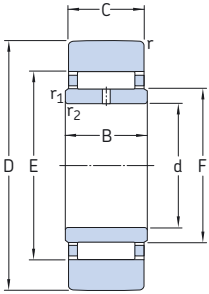


RNA 22...2RS

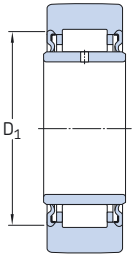
Dimensions						Limiting speed	Mass	Designation
D	C	D_1	F_w	E	r			
mm						r/min	kg	–
16	7,8	–	7	10	0,3	8 000	0,0085	**RSTO 5 TN**
19	9,8	–	10	13	0,3	7 000	0,013	**RSTO 6 TN**
	11,8	16	10	–	0,3	7 000	0,018	**RNA 22/6.2RS**
24	9,8	–	12	15	0,3	7 000	0,021	**RSTO 8 TN**
	11,8	18	12	–	0,3	6 700	0,029	**RNA 22/8.2RS**
30	11,8	–	14	20	0,3	6 000	0,042	**RSTO 10**
	13,8	20	14	–	0,6	6 300	0,052	**RNA 2200.2RS**
32	11,8	–	16	22	0,3	5 600	0,049	**RSTO 12**
	13,8	22	16	–	0,6	6 000	0,057	**RNA 2201.2RS**
35	11,8	–	20	26	0,3	5 000	0,050	**RSTO 15**
	13,8	26	20	–	0,6	5 000	0,060	**RNA 2202.2RS**
40	15,8	28	22	–	1	4 500	0,094	**RNA 2203.2RS**
	15,8	–	22	29	0,3	4 500	0,088	**RSTO 17**
47	15,8	–	25	32	0,3	4 000	0,13	**RSTO 20**
	17,8	33	25	–	1	4 000	0,15	**RNA 2204.2RS**
52	15,8	–	30	37	0,3	3 400	0,15	**RSTO 25**
	17,8	38	30	–	1	3 400	0,18	**RNA 2205.2RS**
62	19,8	43	35	–	1	2 800	0,28	**RNA 2206.2RS**
	19,8	–	38	46	0,6	2 600	0,26	**RSTO 30**
72	19,8	–	42	50	0,6	2 200	0,38	**RSTO 35**
	22,7	50	42	–	1,1	2 200	0,43	**RNA 2207.2RS**
80	19,8	–	50	58	1	1 900	0,42	**RSTO 40**
	22,7	57	48	–	1,1	1 900	0,53	**RNA 2208.2RS**
85	19,8	–	55	63	1	1 700	0,45	**RSTO 45**
90	19,8	–	60	68	1	1 600	0,48	**RSTO 50**

Designation	Basic load ratings dynamic C	static C_0	Fatigue load limit P_u	Maximum radial forces dynamic F_r	static F_{0r}
–	kN		kN	kN	
RSTO 5 TN	2,51	2,5	0,27	3,55	5
RSTO 6 TN	3,74	4,5	0,5	4,25	6,1
RNA 22/6.2RS	3,52	3	0,34	1,93	2,75
RSTO 8 TN	4,13	5,4	0,6	7,5	10,8
RNA 22/8.2RS	4,46	4,4	0,5	5	7,1
RSTO 10	8,25	8,8	1,04	8,5	12,2
RNA 2200.2RS	6,44	7,2	0,85	12	17
RSTO 12	8,8	9,8	1,18	8,3	12
RNA 2201.2RS	6,93	8,15	0,965	11,6	16,6
RSTO 15	9,13	10,6	1,27	7,1	10
RNA 2202.2RS	7,21	9	1,04	9,65	13,7
RNA 2203.2RS	9,35	12,9	1,53	16	22,8
RSTO 17	14,2	17,6	2,08	12	17,3
RSTO 20	16,1	21,2	2,5	18,6	26,5
RNA 2204.2RS	15,4	17,3	2,12	17,6	25,5
RSTO 25	16,5	22,8	2,7	18	26
RNA 2205.2RS	16,1	19	2,32	17,3	24,5
RNA 2206.2RS	17,6	24,5	3	28,5	40,5
RSTO 30	22,9	34,5	4,25	23,6	33,5
RSTO 35	24,6	39	4,8	36	51
RNA 2207.2RS	22	34	4,3	39	56
RSTO 40	23,8	39	4,75	34,5	49
RNA 2208.2RS	27	39	4,9	37,5	53
RSTO 45	25,1	43	5,3	34,5	50
RSTO 50	26	45,5	5,7	34,5	50

Support rollers without flange rings, with an inner ring
D **19 – 90** mm



ST0

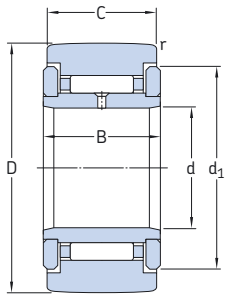


NA 22...2RS

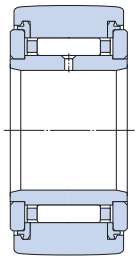
Dimensions									Limiting speed	Mass	Designation
D	d	C	B	D_1	F	E	r min	$r_{1,2}$ min			
mm									r/min	kg	–
19	6	9,8	10	–	10	13	0,3	0,3	7 000	0,017	**ST0 6 TN**
	6	11,8	12	16	10	–	0,3	0,3	7 000	0,022	**NA 22/6.2RS**
24	8	9,8	10	–	12	15	0,3	0,3	7 000	0,026	**ST0 8 TN**
	8	11,8	12	18	12	–	0,3	0,3	6 700	0,034	**NA 22/8.2RS**
30	10	11,8	12	–	14	20	0,3	0,3	6 000	0,049	**ST0 10**
	10	13,8	14	20	14	–	0,6	0,3	6 300	0,06	**NA 2200.2RS**
32	12	11,8	12	–	16	22	0,3	0,3	5 600	0,057	**ST0 12**
	12	13,8	14	22	16	–	0,6	0,3	6 000	0,067	**NA 2201.2RS**
35	15	11,8	12	–	20	26	0,3	0,3	5 000	0,063	**ST0 15**
	15	13,8	14	26	20	–	0,6	0,3	5 000	0,075	**NA 2202.2RS**
40	17	15,8	16	–	22	29	0,3	0,3	4 500	0,11	**ST0 17**
	17	15,8	16	28	22	–	1	0,3	4 500	0,11	**NA 2203.2RS**
47	20	15,8	16	–	25	32	0,3	0,3	4 000	0,15	**ST0 20**
	20	17,8	18	33	25	–	1	0,3	4 000	0,18	**NA 2204.2RS**
52	25	15,8	16	–	30	37	0,3	0,3	3 400	0,18	**ST0 25**
	25	17,8	18	38	30	–	1	0,3	3 400	0,21	**NA 2205.2RS**
62	30	19,8	20	–	38	46	0,6	0,6	2 800	0,31	**ST0 30**
	30	19,8	20	43	35	–	1	0,3	2 600	0,32	**NA 2206.2RS**
72	35	19,8	20	–	42	50	0,6	0,6	2 200	0,44	**ST0 35**
	35	22,7	23	50	42	–	1,1	0,6	2 200	0,51	**NA 2207.2RS**
80	40	19,8	20	–	50	58	1	1	1 900	0,53	**ST0 40**
	40	22,7	23	57	48	–	1,1	0,6	1 900	0,63	**NA 2208.2RS**
85	45	19,8	20	–	55	63	1	1	1 700	0,58	**ST0 45**
90	50	19,8	20	–	60	68	1	1	1 600	0,62	**ST0 50**
	50	22,7	23	68	–	–	1,1	0,6	1 600	0,69	**NA 2210.2RS**

Designation	Basic load ratings dynamic C	static C_0	Fatigue load limit P_u	Maximum radial forces dynamic F_r	static F_{0r}
–	kN		kN	kN	
STO 6 TN	3,74	4,5	0,5	4,25	6,1
NA 22/6.2RS	3,52	3	0,34	1,93	2,75
STO 8 TN	4,13	5,4	0,6	7,5	10,8
NA 22/8.2RS	4,46	4,4	0,5	5	7,1
STO 10	8,25	8,8	1,04	8,5	12,2
NA 2200.2RS	6,44	7,2	0,85	12	17
STO 12	8,8	9,8	1,18	8,3	12
NA 2201.2RS	6,93	8,15	0,965	11,6	16,6
STO 15	9,13	10,6	1,27	7,1	10
NA 2202.2RS	7,21	9	1,04	9,65	13,7
STO 17	14,2	17,6	2,08	12	17,3
NA 2203.2RS	9,35	12,9	1,53	16	22,8
STO 20	16,1	21,2	2,5	18,6	26,5
NA 2204.2RS	15,4	17,3	2,12	17,6	25,5
STO 25	16,5	22,8	2,7	18	26
NA 2205.2RS	16,1	19	2,32	17,3	24,5
STO 30	22,9	34,5	4,25	23,6	33,5
NA 2206.2RS	17,6	24,5	3	28,5	40,5
STO 35	25,5	40,5	5	36	51
NA 2207.2RS	22	34	4,3	39	56
STO 40	23,8	39	4,75	34,5	49
NA 2208.2RS	27	39	4,9	37,5	53
STO 45	25,1	43	5,3	34,5	50
STO 50	26	45,5	5,7	34,5	50
NA 2210.2RS	27	41,5	5,2	36,5	52

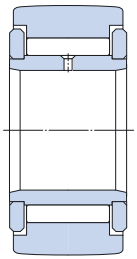
Support rollers with flange rings, with an inner ring
D **16 – 40** mm



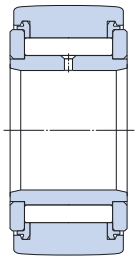
NATR



NATR .. PPA

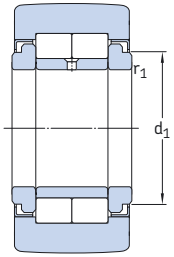


NATV

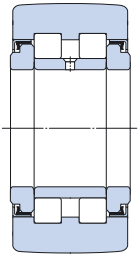


NATV .. PPA

Dimensions							Limiting speed	Mass	Designation
D	d	C	B	d_1	r min	$r_{1,2}$ min			
mm							r/min	kg	–
16	5	11	12	12	0,15	–	6 000	0,014	**NATR 5**
	5	11	12	12	0,15	–	6 000	0,014	**NATR 5 PPA**
	5	11	12	12	0,15	–	4 300	0,015	**NATV 5**
	5	11	12	12	0,15	–	4 300	0,015	**NATV 5 PPA**
19	6	11	12	14	0,15	–	5 600	0,02	**NATR 6**
	6	11	12	14	0,15	–	5 600	0,02	**NATR 6 PPA**
	6	11	12	14	0,15	–	4 000	0,021	**NATV 6**
	6	11	12	14	0,15	–	4 000	0,021	**NATV 6 PPA**
24	8	14	15	19	0,3	–	5 000	0,041	**NATR 8**
	8	14	15	19	0,3	–	5 000	0,041	**NATR 8 PPA**
	8	14	15	19	0,3	–	3 600	0,042	**NATV 8**
	8	14	15	19	0,3	–	3 600	0,042	**NATV 8 PPA**
30	10	14	15	23	0,6	–	4 800	0,064	**NATR 10**
	10	14	15	23	0,6	–	4 800	0,064	**NATR 10 PPA**
	10	14	15	23	0,6	–	3 200	0,065	**NATV 10**
	10	14	15	23	0,6	–	3 200	0,065	**NATV 10 PPA**
32	12	14	15	25	0,6	–	4 500	0,071	**NATR 12**
	12	14	15	25	0,6	–	4 500	0,071	**NATR 12 PPA**
	12	14	15	25	0,6	–	3 000	0,072	**NATV 12**
	12	14	15	25	0,6	–	3 000	0,072	**NATV 12 PPA**
35	15	18	19	27	0,6	–	4 000	0,1	**NATR 15**
	15	18	19	27	0,6	–	4 000	0,1	**NATR 15 PPA**
	15	18	19	27	0,6	–	2 600	0,11	**NATV 15**
	15	18	19	27	0,6	–	2 600	0,11	**NATV 15 PPA**
	15	18	19	20	0,6	0,6	5 000	0,1	**NUTR 15 A**
	15	18	19	20	0,6	0,6	5 000	0,1	**PWTR 15.2RS**
40	17	20	21	32	1	–	3 400	0,14	**NATR 17**
	17	20	21	32	1	–	3 400	0,14	**NATR 17 PPA**
	17	20	21	32	1	–	2 200	0,15	**NATV 17**
	17	20	21	32	1	–	2 200	0,15	**NATV 17 PPA**
	17	20	21	22	1	0,5	4 500	0,15	**NUTR 17 A**
	17	20	21	22	1	0,5	4 500	0,15	**PWTR 17.2RS**



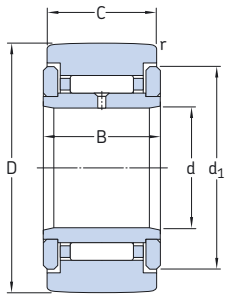
NUTR .. A



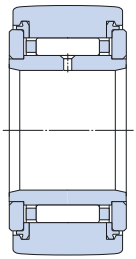
PWTR ...2RS

Designation	Basic load ratings dynamic C	static C_0	Fatigue load limit P_u	Maximum radial forces dynamic F_r	static F_{0r}
–	kN		kN	kN	
NATR 5	3,14	3,2	0,345	2,9	4,15
NATR 5 PPA	3,14	3,2	0,345	2,9	4,15
NATV 5	4,73	6,55	0,72	4,05	5,7
NATV 5 PPA	4,73	6,55	0,72	4,05	5,7
NATR 6	3,47	3,8	0,415	3,8	5,5
NATR 6 PPA	3,47	3,8	0,415	3,8	5,5
NATV 6	5,28	8	0,88	5,1	7,35
NATV 6 PPA	5,28	8	0,88	5,1	7,35
NATR 8	5,28	6,1	0,695	5,2	7,35
NATR 8 PPA	5,28	6,1	0,695	5,2	7,35
NATV 8	7,48	11,4	1,32	7,35	10,4
NATV 8 PPA	7,48	11,4	1,32	7,35	10,4
NATR 10	6,44	8	0,88	7,8	11,2
NATR 10 PPA	6,44	8	0,88	7,8	11,2
NATV 10	8,97	14,6	1,66	11	15,6
NATV 10 PPA	8,97	14,6	1,66	11	15,6
NATR 12	6,6	8,5	0,95	7,65	10,8
NATR 12 PPA	6,6	8,5	0,95	7,65	10,8
NATV 12	9,35	15,3	1,76	10,6	15
NATV 12 PPA	9,35	15,3	1,76	10,6	15
NATR 15	9,52	13,7	1,56	11,4	16,3
NATR 15 PPA	9,52	13,7	1,56	11,4	16,3
NATV 15	12,3	23,2	2,7	14,6	20,8
NATV 15 PPA	12,3	23,2	2,7	14,6	20,8
NUTR 15 A	16,8	17,6	2	8,65	12,2
PWTR 15.2RS	11,9	11,4	1,2	8,65	12,5
NATR 17	10,5	14,6	1,73	12,5	18
NATR 17 PPA	10,5	14,6	1,73	12,5	18
NATV 17	14,2	26,5	3,1	17	24,5
NATV 17 PPA	14,2	26,5	3,1	17	24,5
NUTR 17 A	19	22	2,5	14	20
PWTR 17.2RS	13,8	14,3	1,5	13,7	19,6

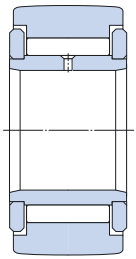
Support rollers with flange rings, with an inner ring
D **42 – 72** mm



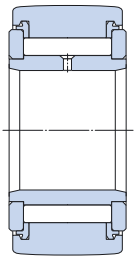
NATR



NATR .. PPA

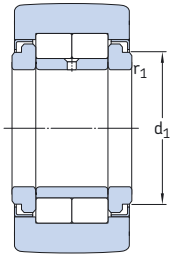


NATV

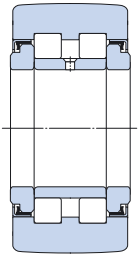


NATV .. PPA

Dimensions							Limiting speed	Mass	Designation
D	d	C	B	d_1	r min	$r_{1,2}$ min			
mm							r/min	kg	–
42	15	18	19	20	0,6	0,3	5 000	0,16	**NUTR 1542 A**
	15	18	19	20	0,6	0,3	5 000	0,16	**PWTR 1542.2RS**
47	17	20	21	22	1	0,5	4 500	0,22	**NUTR 1747 A**
	17	20	21	22	1	0,5	4 500	0,22	**PWTR 1747.2RS**
	20	24	25	37	1	–	3 000	0,25	**NATR 20**
	20	24	25	37	1	–	3 000	0,25	**NATR 20 PPA**
	20	24	25	37	1	–	1 900	0,25	**NATV 20**
	20	24	25	37	1	–	1 900	0,25	**NATV 20 PPA**
	20	24	25	27	1	0,5	3 800	0,25	**NUTR 20 A**
	20	24	25	27	1	0,5	3 800	0,25	**PWTR 20.2RS**
52	20	24	25	27	1	0,5	3 800	0,32	**NUTR 2052 A**
	20	24	25	27	1	0,5	3 800	0,32	**PWTR 2052.2RS**
	25	24	25	42	1	–	2 400	0,28	**NATR 25**
	25	24	25	42	1	–	2 400	0,28	**NATR 25 PPA**
	25	24	25	42	1	–	1 600	0,29	**NATV 25**
	25	24	25	42	1	–	1 600	0,29	**NATV 25 PPA**
	25	24	25	31	1	0,5	3 200	0,28	**NUTR 25 A**
	25	24	25	31	1	0,5	3 200	0,28	**PWTR 25.2RS**
62	25	24	25	31	1	0,5	3 200	0,45	**NUTR 2562 A**
	25	24	25	31	1	0,5	3 200	0,45	**PWTR 2562.2RS**
	30	28	29	51	1	–	1 800	0,47	**NATR 30**
	30	28	29	51	1	–	1 800	0,47	**NATR 30 PPA**
	30	28	29	51	1	–	1 400	0,48	**NATV 30**
	30	28	29	51	1	–	1 400	0,48	**NATV 30 PPA**
	30	28	29	38	1	0,5	2 600	0,47	**NUTR 30 A**
	30	28	29	38	1	0,5	2 600	0,47	**PWTR 30.2RS**
72	30	28	29	38	1	0,5	2 600	0,7	**NUTR 3072 A**
	30	28	29	38	1	0,5	2 000	0,7	**PWTR 3072.2RS**
	35	28	29	58	1,1	–	1 600	0,64	**NATR 35 PPA**
	35	28	29	58	1,1	–	1 100	0,65	**NATV 35 PPA**
	35	28	29	44	1,1	0,6	2 000	0,63	**NUTR 35 A**
	35	28	29	44	1,1	0,6	2 000	0,63	**PWTR 35.2RS**



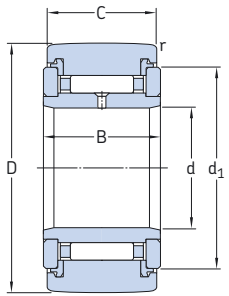
NUTR .. A



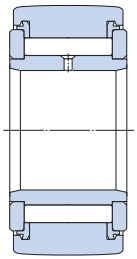
PWTR ...2RS

Designation	Basic load ratings dynamic C	static C_0	Fatigue load limit P_u	Maximum radial forces dynamic F_r	static F_{0r}
–	kN		kN	kN	
NUTR 1542 A	20,1	23,2	2,65	21,6	31
PWTR 1542.2RS	14,2	15	1,6	22	31,5
NUTR 1747 A	22	27	3,05	30	43
PWTR 1747.2RS	15,7	17,6	1,86	30	42,5
NATR 20	14,7	24,5	2,9	23,6	33,5
NATR 20 PPA	14,7	24,5	2,9	23,6	33,5
NATV 20	19,4	41,5	5	30,5	43
NATV 20 PPA	19,4	41,5	5	30,5	43
NUTR 20 A	28,6	33,5	3,9	17,6	25
PWTR 20.2RS	22,9	24,5	2,8	18,3	26
NUTR 2052 A	31,9	39	4,55	30	42,5
PWTR 2052.2RS	25,5	29	3,35	30,5	44
NATR 25	14,7	25,5	3,1	21,6	31
NATR 25 PPA	14,7	25,5	3,1	21,6	31
NATV 25	19,8	44	5,3	28,5	40,5
NATV 25 PPA	19,8	44	5,3	28,5	40,5
NUTR 25 A	29,7	36	4,25	18	25,5
PWTR 25.2RS	23,8	26,5	3,05	18,6	26,5
NUTR 2562 A	35,8	48	5,6	44	63
PWTR 2562.2RS	29,2	36	4,05	45	64
NATR 30	22,9	37,5	4,55	26,5	38
NATR 30 PPA	22,9	37,5	4,55	26,5	38
NATV 30	29,2	62	7,65	34,5	49
NATV 30 PPA	29,2	62	7,65	34,5	49
NUTR 30 A	41,3	47,5	5,85	24	34,5
PWTR 30.2RS	31,9	32,5	4,05	20,4	29
NUTR 3072 A	48,4	61	7,5	53	76,5
PWTR 3072.2RS	39,6	45	5,6	47,5	68
NATR 35 PPA	24,6	43	5,3	33,5	48
NATV 35 PPA	31,9	72	8,8	43	62
NUTR 35 A	45,7	57	6,95	33,5	47,5
PWTR 35.2RS	35,8	40,5	5	28	40

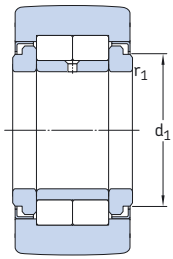
Support rollers with flange rings, with an inner ring
D **80 – 240** mm



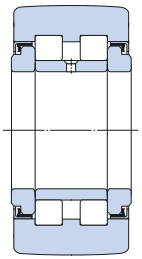
NATR .. PPA



NATV .. PPA

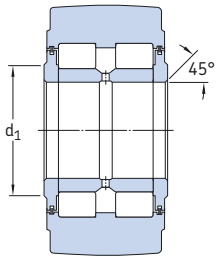


NUTR .. A



PWTR ...2RS

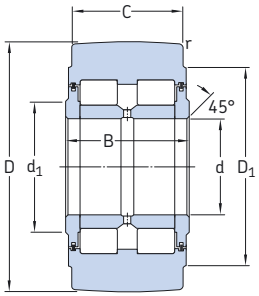
Dimensions							Limiting speed	Mass	Designation
D	d	C	B	d_1	r min	$r_{1,2}$ min			
mm							r/min	kg	–
80	35	28	29	44	1,1	0,6	2 000	0,84	**NUTR 3580 A**
	35	28	29	44	1,1	0,6	2 000	0,84	**PWTR 3580.2RS**
	40	30	32	66	1,1	–	1 500	0,81	**NATR 40 PPA**
	40	30	32	66	1,1	–	950	0,89	**NATV 40 PPA**
	40	30	32	51	1,1	0,6	1 800	0,82	**NUTR 40 A**
	40	30	32	51	1,1	0,6	1 800	0,82	**PWTR 40.2RS**
85	45	30	32	55	1,1	0,6	1 700	0,88	**NUTR 45 A**
	45	30	32	55	1,1	0,6	1 700	0,88	**PWTR 45.2RS**
90	40	30	32	51	1,1	0,6	1 800	1,13	**NUTR 4090 A**
	40	30	32	51	1,1	0,6	1 800	1,13	**PWTR 4090.2RS**
	50	30	32	76	1,1	–	1 200	0,96	**NATR 50 PPA**
	50	30	32	76	1,1	–	850	0,99	**NATV 50 PPA**
	50	30	32	60	1,1	0,6	1 600	0,95	**NUTR 50 A**
	50	30	32	60	1,1	0,6	1 600	0,95	**PWTR 50.2RS**
100	45	30	32	55	1,1	0,6	1 700	1,4	**NUTR 45100 A**
	45	30	32	55	1,1	0,6	1 700	1,4	**PWTR 45100.2RS**
110	50	30	32	60	1,1	0,6	1 600	1,7	**NUTR 50110 A**
	50	30	32	60	1,1	0,6	1 600	1,7	**PWTR 50110.2RS**
130	50	63	65	63	3	2	750	5,2	**NNTR 50x130x65.2ZL**
140	55	68	70	73	3	2	700	6,4	**NNTR 55x140x70.2ZL**
150	60	73	75	78	3	2	670	7,8	**NNTR 60x150x75.2ZL**
160	65	73	75	82	3	2	600	8,8	**NNTR 65x160x75.2ZL**
180	70	83	85	92	3	2	560	13	**NNTR 70x180x85.2ZL**
200	80	88	90	102	4	2	500	17	**NNTR 80x200x90.2ZL**
220	90	98	100	119	4	2,5	430	22,5	**NNTR 90x220x100.2ZL**
240	100	103	105	132	4	2,5	380	28	**NNTR 100x240x105.2ZL**



NNTR ...2ZL

Designation	Basic load ratings dynamic	static	Fatigue load limit	Maximum radial forces dynamic	static
	C	C_0	P_u	F_r	F_{0r}
–	kN		kN	kN	
NUTR 3580 A	51,2	68	8,3	57	81,5
PWTR 3580.2RS	41,8	50	6,3	51	72
NATR 40 PPA	31,9	57	7,1	41,5	58,5
NATV 40 PPA	39,1	88	11	51	73,5
NUTR 40 A	57,2	72	9	32	45,5
PWTR 40.2RS	41,8	49	6	33,5	48
NUTR 45 A	58,3	75	9,3	32,5	46,5
PWTR 45.2RS	42,9	50	6,2	34	48
NUTR 4090 A	68,2	91,5	11,4	63	90
PWTR 4090.2RS	49,5	62	7,65	64	91,5
NATR 50 PPA	30,8	58,5	7,2	40	57
NATV 50 PPA	39,1	93	11,6	50	72
NUTR 50 A	58,3	78	9,65	32,5	47,5
PWTR 50.2RS	42,9	52	6,55	34,5	49
NUTR 45100 A	73,7	104	12,7	80	114
PWTR 45100.2RS	53,9	69,5	8,65	81,5	116
NUTR 50110 A	78,1	116	14,3	98	140
PWTR 50110.2RS	57,2	78	9,65	100	143
NNTR 50x130x65.2ZL	179	232	31	224	320
NNTR 55x140x70.2ZL	209	275	37,5	224	320
NNTR 60x150x75.2ZL	238	320	42,5	265	375
NNTR 65x160x75.2ZL	255	345	46,5	285	405
NNTR 70x180x85.2ZL	330	455	61	375	540
NNTR 80x200x90.2ZL	391	540	71	455	640
NNTR 90x220x100.2ZL	468	670	83	480	680
NNTR 100x240x105.2ZL	528	780	93	550	780

Support rollers with flange rings, with an inner ring
D **260 – 310** mm



NNTR ...2ZL

Dimensions							Limiting speed	Mass	Designation
D	d	C	B	d_1	r min	$r_{1,2}$ min			
mm							r/min	kg	–
260	110	113	115	143	4	2,5	360	35,5	**NNTR 110x260x115.2ZL**
290	120	133	135	155	4	3	320	53	**NNTR 120x290x135.2ZL**
310	130	144	146	165	5	3	300	65	**NNTR 130x310x146.2ZL**

Designation	Basic load ratings dynamic	static	Fatigue load limit	Maximum radial forces dynamic	static
	C	C_0	P_u	F_r	F_{0r}
–	kN		kN	kN	
NNTR 110x260x115.2ZL	627	930	112	655	950
NNTR 120x290x135.2ZL	825	1270	143	900	1290
NNTR 130x310x146.2ZL	952	1460	166	1040	1500

Cam followers

SKF cam followers have an internal design very similar to that of a needle or cylindrical roller bearing. They are characterized by a thick-walled outer ring that enables them to accommodate shock loads while reducing distortion and bending stresses. The outer ring running surface is crowned as standard (→ **page 243**). However, cam followers with cylindrical (flat) running surfaces are available for certain applications.

Instead of an inner ring, cam followers have a solid stud (pin) that is threaded so that the cam follower can be quickly and easily attached to appropriate machine components by means of a hexagonal nut.

Axial guidance for the outer ring is provided by an integral flange at the head of the stud and a flange ring pressed onto the stud, or by the roller complement. Cam followers are pre-greased, ready-to-mount units that are suitable for all types of cam drives, tracks and conveyor systems.

SKF cam followers are available in three basic designs:

- KR design
- NUKR design
- PWKR design

All three cam follower designs have the same main dimensions. The differences are in their internal design, which make them suitable for various operating conditions.

All designs are available with a concentric seat (→ **fig. 18**) or an eccentric collar on the stud. An eccentric collar (→ **fig. 19**), which has a shrink-fit onto the stud, enables less stringent manufacturing tolerances to be specified for associated components. The values for the adjustable eccentricity are listed in the product tables.

Fig. 18

Cam follower with a concentric seat

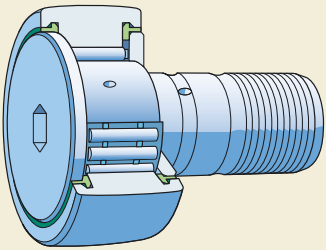


Fig. 19

Cam follower with an eccentric collar

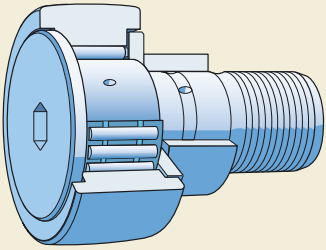
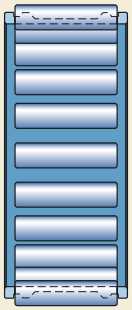


Fig. 20

Machined steel cage



KR design cam followers

KR design cam followers are fitted with a needle roller and cage assembly (→ **fig. 20**). The steel cage guides the rollers over their entire length, permitting relatively high-speed operation. The outer ring is guided axially by the pressed-on flange ring and the head of the stud, which also serves as an integral flange.

KR design cam followers without a designation suffix or with the designation suffix B (→ **fig. 21**) have a narrow gap between the outer ring and the two flanges and serves as a gap type seal.

KR design cam followers with the designation suffix PPA have axial sliding rings made of polyamide 66 (→ **fig. 22**). In the radial direction, the sliding ring forms a narrow labyrinth seal with the outer ring to protect against coarse contaminants. In the axial direction, the sliding ring serves as a contact seal to reliably retain grease in the bearing. This improves the lubrication conditions in the bearing, keeps friction and heat low, and extends grease service life.

Fig. 21

KR design cam follower, designation suffix B, sizes 22 and 26

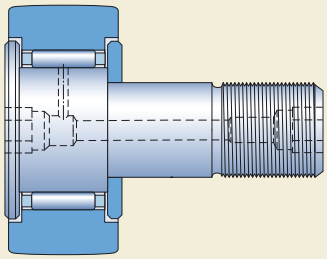
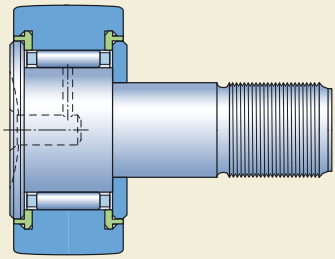
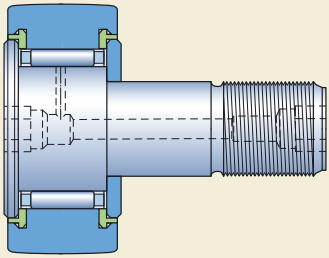


Fig. 22

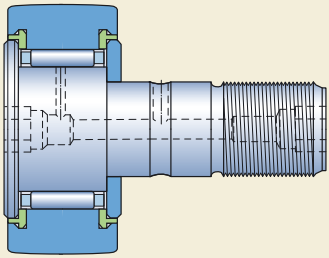
KR design cam follower, designation suffix PPA



a) sizes 16 and 19



b) sizes 22 and 26



c) from size 30

KR design cam followers, sizes 16 and 19, either without a designation suffix or with the designation suffix PPA (→ **fig. 22a**, **page 239**), have one slot in the head of the stud that enables the stud to be held in place by a screwdriver during mounting. In the centre of that slot is a relubrication hole to press in a grease fitting or a plug if relubrication is not required. See section *Accessories*, starting on **page 244**. SKF also supplies these two sizes with a hexagon recessed into the head of the stud. They are fitted with sliding rings made of polyamide 66 and are identified by the designation suffix PPSKA. Cam followers with the designation suffix PPSKA are not equipped with a lubrication duct and cannot be relubricated (→ **fig. 23**).

KR design cam followers with the designation suffix B, sizes 22 and larger, have a recessed hexagon at each end of the stud. However, sizes 22 and 26 (→ **fig. 21**) do not have an annular groove and lubrication hole in the central part of the stud. In the centre of each hexagon is a relubrication hole to press in a grease fitting, if needed. Sizes 35 and larger can accommodate adapters from a central lubrication system. See section *Accessories*, starting on **page 244**. For cam followers from size 30 and larger, the lubricant can also be supplied via a relubrication hole with an annular groove in the seat.

KRE design cam followers

KRE design cam followers are similar to the KR design with a PPA designation suffix. The difference is that the KRE design has an eccentric collar pressed onto the stud (→ **fig. 24**). Because the eccentric collar covers the duct in the stud, these cam followers can only be relubricated via the stud ends.

KRV design cam followers

KRV design cam followers are similar to the KR design with a designation suffix PPA. The difference is that the KRV design has a full complement of needle rollers (→ **fig. 25**). Therefore, KRV design cam followers can accommodate heavier radial loads than KR design cam followers. However, they are not able to operate at the same high speeds and require more frequent relubrication.

Fig. 23

KR design cam follower, designation suffix PPSKA

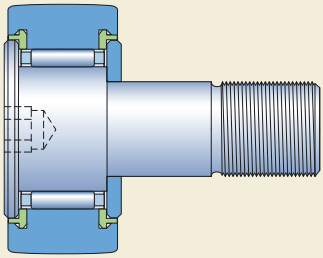


Fig. 24

KRE design cam follower, designation suffix PPA, sizes 30 and larger

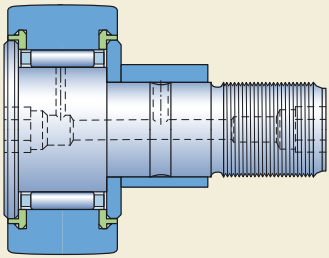
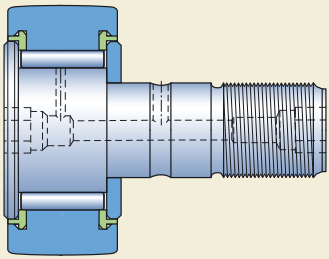


Fig. 25

KRV design cam follower, designation suffix PPA, sizes 30 and larger



NUKR design cam followers

NUKR .. A design cam followers

NUKR .. A design cam followers (→ **fig. 26**) are based on the design of a double row, full complement cylindrical roller bearing. The outer ring has two integral flanges that guide the roller complements axially. The stud head and a pressed-on flange ring provide axial guidance for the outer ring via the rollers. This enables NUKR .. A design cam followers to accommodate the heavy axial forces that result when operating in an inclined or tilted position and to operate at relatively high speeds.

NUKR .. A design cam followers have a recessed hexagon at each end of the stud, to enable the cam follower to be held in place by a hexagonal key (Allen wrench) during mounting. In the centre of each hexagon is a relubrication hole for a press-in grease fitting or an adapter from a central lubrication system. See section *Accessories*, starting on **page 244**. Lubricant can also be applied via the relubrication hole and the annular groove in the seat.

Sheet metal angle rings that are pressed into the outer ring and extend over the stud head and the flange ring form efficient labyrinth seals.

NUKRE .. A design cam followers

NUKRE .. A design cam followers are similar to the NUKR .. A design. The difference is that the NUKRE .. A design has an eccentric collar pressed onto the stud (→ **fig. 27**). Because the eccentric collar covers the duct in the stud, these cam followers can only be relubricated via the stud ends.

Fig. 26

NUKR .. A design cam follower

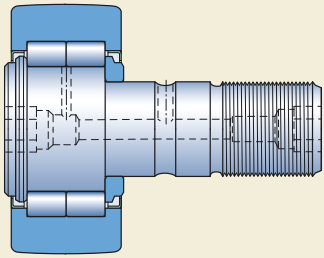
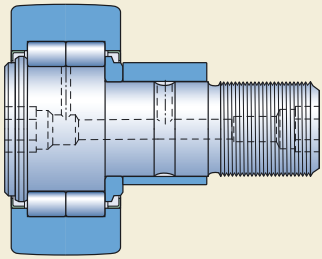


Fig. 27

NUKRE .. A design cam follower



PWKR design cam followers

PWKR ...2RS design cam followers

PWKR ...2RS design cam followers (→ **fig. 28**) have an outer ring with three integral flanges. They axially guide the two rows of full complement rollers separately to minimize friction in the cam follower, thereby reducing the amount of heat generated by the bearing. The stud head and a pressed-on flange ring provide axial guidance for the outer ring via the rollers. This enables the cam followers to accommodate the relatively heavy constant axial loads that occur when cam followers operate in an inclined position.

PWKR ...2RS design cam followers have a contact seal of oil and wear-resistant acrylonitrile-butadiene rubber (NBR) on both sides. The seals are integral with the angle rings that are pressed in the outer ring and seal against the stud head and the flange ring. The sheet metal angle rings extend over the stud head and the flange ring to form secondary labyrinth seals, making them particularly suitable for operation under arduous conditions.

The large space between the two rows of rollers enables a large quantity of grease to be incorporated. The large grease fill and efficient sealing method make it possible to operate PWKR ...2RS design cam followers for longer periods between maintenance intervals than was previously possible, even under contaminated conditions.

They also have a recessed hexagon at both ends of the stud that enables the cam follower to be held in place by a hexagonal key (Allen wrench) during mounting. In the centre of each hexagon is a relubrication hole for a press-in grease fitting or an adapter from a central lubrication system. See section *Accessories*, starting on **page 244**. Lubricant can also be applied via the relubrication hole and the annular groove in the seat.

PWKRE ...2RS design cam followers

PWKRE ...2RS design cam followers are similar to PWKR .. 2RS design cam followers. The difference is that the PWKRE ...2RS design has an eccentric collar pressed onto the stud (→ **fig. 29**). Because the eccentric collar covers the lubrication duct in the stud, these cam followers can only be relubricated via the stud ends.

Fig. 28

PWKR ...2RS design cam follower

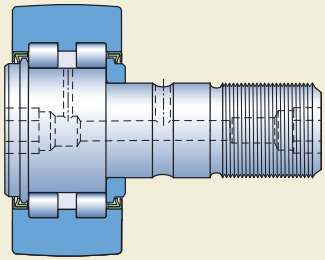
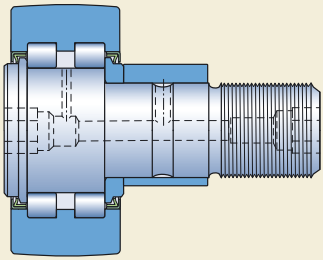


Fig. 29

PWKRE ...2RS design cam follower



Profile of the outer ring running surface

Crowned outer ring running surface

SKF supplies cam followers, as standard, with a crowned outer ring running surface. The crowned outer ring running surface provides good load distribution during operation when the bearing is in a tilted or inclined position.

KR design cam followers, without designation suffix or with designation suffix B, have a crowned running surface with a radius of 500 mm.

SKF also supplies cam followers with an improved crowned profile of the outer ring running surface. The modified line contact provides even better load distribution than cam followers with the standard radius. In practice, this modified line contact provides a higher degree of stiffness while reducing wear between the outer ring running surface and the track. The following cam follower designs have an improved crowned profile:

- KR design, with the designation suffixes PPA and PPSKA
- NUKR design
- PWKR design

Cylindrical outer ring running surface

SKF recommends cam followers with a cylindrical (flat) outer ring running surface for applications requiring a high degree of stiffness and when running in a tilted or inclined position can be avoided. They are identified by the designation suffix X. These cam followers are dimensionally interchangeable with standard profile cam followers. For additional information, contact the SKF application engineering service.

Accessories

The accessories (→ **table 4**) are intended to provide SKF cam followers with reliable lubrication and location. SKF supplies grease fittings and hexagonal nuts with the cam followers as standard, however, other accessories must be ordered separately.

Grease fittings

SKF supplies grease fittings that can be pressed into position, with each cam follower as standard (→ **table 4**). These are the only grease fittings that should be used. Dimensions are listed in **table 2**.

Note

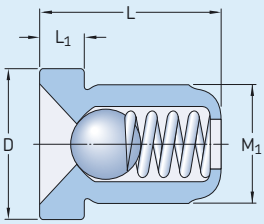
For KR design cam followers, sizes 16 and 19, the head of the grease fitting protrudes from the head end of the stud by 1,5 mm.

Hexagonal nuts

SKF supplies the appropriate hexagonal nuts with each cam follower as standard. They are in accordance with ISO 4032:1999 or ISO 8673:1999. These 8.8 strength class nuts are zinc galvanized to ISO 4042:1999. Dimensions and recommended tightening torques are listed in **table 3**.

Table 2

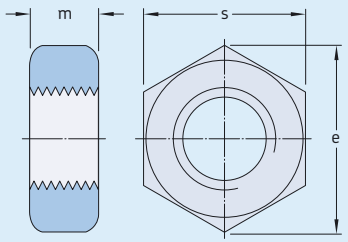
Grease fittings



Designation	Dimensions M_1	D	L	L_1
–	mm			
NIP A1	4	6	6	1,5
NIP A1×4,5	4	4,7	4,5	1
NIP A2×7,5	6	7,5	7,5	2
NIP A3×9,5	8	10	9,5	3

Table 3

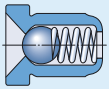
Hexagonal nuts



Size	Dimensions m	e	s	Tightening torque	Standard[1)]
–	mm			Nm	–
M 6×1	5,2	11	10	3	1
M 8×1,25	6,8	14,4	13	8	1
M 10×1	8,4	17,8	16	15	2
M 12×1,5	10,8	20	18	22	2
M 16×1,5	14,8	26,8	24	58	2
M 18×1,5	15,8	29,6	27	87	2
M 20×1,5	18	33	30	120	2
M 24×1,5	21,5	39,5	36	220	2
M 30×1,5	25,6	50,9	46	450	2

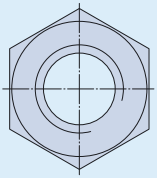
[1)] 1 = EN ISO 4032:2001, ISO 4032:1999
2 = EN ISO 8673:2001, ISO 8673:1999

Accessories for cam followers

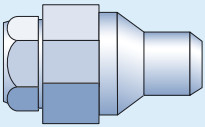


Grease fitting

Plug



Hexagonal nut



Adapter

Cam follower Design	Size without seals	with seals	Supplied with cam follower Grease fitting	Hexagonal nut	To be ordered separately Plug	Adapter
KR **KRE** **KRV**						
	16	**16 PPA**	NIP A1	M 6 × 1	VD1	–
	–	**16 PPSKA**	–	M 6 × 1	–	–
	19	**19 PPA**	NIP A1	M 8×1,25	VD1	–
	–	**19 PPSKA**	–	M 8×1,25	–	–
	22 B	**22 PPA**	2 × NIP A1×4,5	M 10×1	–	–
	26 B	**26 PPA**	2 × NIP A1×4,5	M 10×1	–	–
	30 B	**30 PPA**	2 × NIP A1×4,5	M 12×1,5	–	–
	32 B	**32 PPA**	2 × NIP A1×4,5	M 12×1,5	–	–
	35 B	**35 PPA**	2 × NIP A2×7,5	M 16×1,5	–	AP 8
	40 B	**40 PPA**	2 × NIP A2×7,5	M 18×1,5	–	AP 8
	–	**47 PPA**	2 × NIP A2×7,5	M 20×1,5	–	AP 10
	–	**52 PPA**	2 × NIP A2×7,5	M 20×1,5	–	AP 10
	–	**62 PPA**	2 × NIP A3×9,5	M 24×1,5	–	AP 14
	–	**72 PPA**	2 × NIP A3×9,5	M 24×1,5	–	AP 14
	–	**80 PPA**	2 × NIP A3×9,5	M 30×1,5	–	AP 14
	–	**90 PPA**	2 × NIP A3×9,5	M 30×1,5	–	AP 14
NUKR .. A **NUKRE .. A** **PWKR ...2RS** **PWKRE ...2RS**						
	–	**35**	2 × NIP A2×7,5	M 16×1,5	–	AP 8
	–	**40**	2 × NIP A2×7,5	M 18×1,5	–	AP 8
	–	**47**	2 × NIP A2×7,5	M 20×1,5	–	AP 10
	–	**52**	2 × NIP A2×7,5	M 20×1,5	–	AP 10
	–	**62**	2 × NIP A3×9,5	M 24×1,5	–	AP 14
	–	**72**	2 × NIP A3×9,5	M 24×1,5	–	AP 14
	–	**80**	2 × NIP A3×9,5	M 30×1,5	–	AP 14
	–	**90**	2 × NIP A3×9,5	M 30×1,5	–	AP 14

Plugs

The end of the relubrication hole in the stud of KR design cam followers, sizes 16 and 19, except those with the designation suffix PPSKA, can be plugged if relubrication is not required and if there is no space for the head of the grease fitting. Appropriate plugs with a VD1 designation must be ordered separately. The plug should be pressed into place using a mandrel (→ **fig. 30**).

Adapters for connecting to a centralized lubrication system

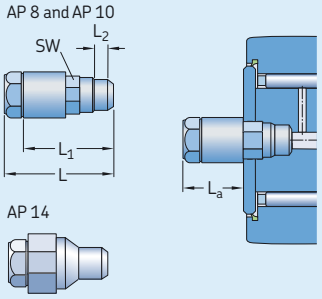
AP design adapters enable cam followers to be relubricated via a centralized lubrication system. These adapters have a quick connection that accommodates, for example, 4×0,75 polyamide tubing in accordance with DIN 73378:1996 (→ **fig. 31**). The designs and dimensions are listed in **table 5**.

Dimensions

The dimensions of SKF cam followers are in accordance with ISO 7063:2003 and ANSI/ABMA Standard 18.1-1982.

Table 5

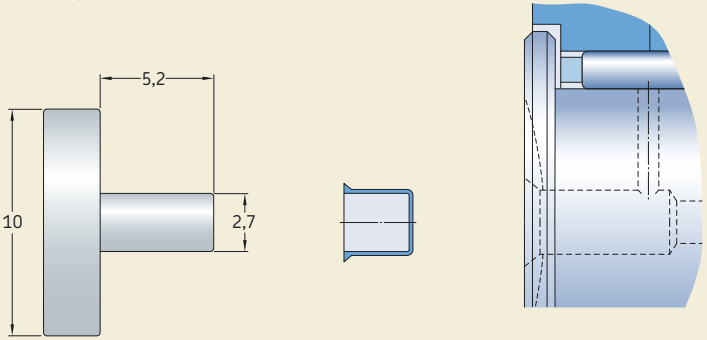
Dimensions of adapters for connecting to a centralized lubrication system



Designation	Dimensions				
	L	L_1	L_2	L_a	SW
–	mm				
AP 8	27	22	4	16	8
AP 10	27	22	5	15	10
AP 14	25	20	6	8	14

Fig. 30

Inserting the VD1 plug with a mandrel



Tolerances

The tolerances of KR, KRE and KRV design cam followers are in accordance with ISO 7063:2003. Other SKF cam followers are made to Normal tolerances in accordance with ISO 492:2002. Exceptions are:

- the tolerance of the outside diameter running surface with a crowned profile, which is 0/–0,050 mm
- the tolerance of the stud shank diameter, h7 tolerance class
- the tolerance for the eccentric collar diameter, h9 tolerance class

The limits for h7 and h9 tolerance classes are listed in **table 6**.

Table 6

ISO tolerance classes

Nominal diameter		**h7** Deviations		**h9** Deviations	
over	incl.	high	low	high	low
mm		µm		µm	
3	**6**	0	–12	0	–30
6	**10**	0	–15	0	–36
10	**18**	0	–18	0	–43
18	**30**	0	–21	0	–52
30	**50**	0	–25	0	–62

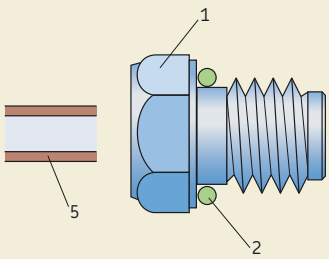
Internal clearance

SKF supplies cam followers with a C2 radial internal clearance.

The clearance values are listed in **table 7** on **page 42** and are in accordance with ISO 5753:1991.

Fig. 31

Adapter for connection to centralized lubrication system



1 Quick connection
2 O-ring
3 Adapter connection
4 Female thread M 10x1
5 Polyamide tube

Load carrying capacity

Compared to a typical rolling bearing, where the outer ring is fully supported in a housing, a cam follower has only a small contact area between its outer ring running surface and the track. The actual contact area depends on the applied radial load and whether the running surface is crowned or flat. The deformation of the outer ring, caused by this limited contact, alters the force distribution in the bearing, which affects load carrying capacity. The basic load ratings listed in the product tables take this into account.

The ability to accommodate dynamic loads depends on the requisite life, but it is also important to consider the strength of the outer ring, therefore, the value of the maximum dynamic radial load F_r should not be exceeded.

The permissible static load for a cam follower is determined by the smaller of the values F_{0r} and C_0. If requirements for smooth running are below normal, the static load may exceed C_0 but should never exceed the maximum permissible static radial load F_{0r}.

Permissible operating temperature

Generally, the permissible temperature range for cam followers is –30 to +140 °C. However, exceptions due to the seal material are:

- –30 to +100 °C for KR design, designation suffixes PPSKA and PPA
- –30 to + 120 °C for PWKR ...2RS and PWKRE ...2RS design

Exceptions due to the applied grease must also be taken into account.

For additional information about temperature restrictions, refer to the sections *Cage materials* (→ **page 44**) and *Lubrication* (→ **page 52**).

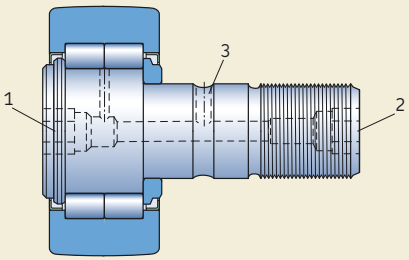
Lubrication

All cam followers are filled at the factory with a high-quality grease with good corrosion inhibiting properties.

Although SKF cam followers require little maintenance, they must be relubricated to achieve their full service life. This can be done via ducts in the stud (→ **fig. 32**):

Fig. 32

Possibilities for relubrication



- from the head (bearing) end of the stud (**1**)
- from the thread end of the stud (**2**)
- through the relubrication hole and the annular groove in the seat on the stud shank (**3**)

Exceptions are:

- KR design cam followers, sizes 16 and 19, without a designation suffix or with a designation suffix PPA, which can only be relubricated via the head end
- KR design cam followers, sizes 16 and 19, designation suffix PPSKA, which cannot be relubricated
- KRE, NUKRE and PWKRE design cam followers, which can only be relubricated via the stud ends
- KR design cam followers, sizes 22 and 26, designation suffixes B or PPA, which can only be relubricated via the stud ends

SKF recommends relubrication while the initial grease fill still has its full lubricating properties. Cam followers used in applications where there are light loads, relatively low speeds and clean surroundings, can operate for long periods before relubrication is required. Cam followers that operate under contaminated and damp conditions, at high speeds or at temperatures above +70 °C, require frequent relubrication. Full complement KRV and NUKR design cam followers require more frequent relubrication. SKF recommends using SKF LGWA 2 grease for relubrication.

For additional information and characteristics (→ **table 1, page 54**) of the initial grease fill and SKF LGWA 2 grease, refer to the section *Lubrication*, starting on **page 52**.

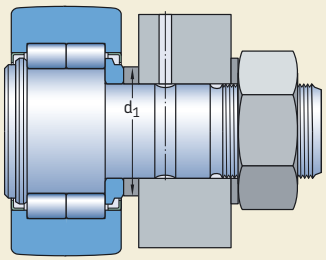
For cam followers from size 35 and larger, the lubrication ducts are also suitable for connection to a central lubrication system. See section *Accessories*, starting on **page 244**.

Design of associated components

The flange ring that is pressed onto the stud shank should be supported axially over its entire side face. The support surface should have a diameter according to diameter d_1 (→ **fig. 33**). The bore through which the stud is attached should be machined to H7 tolerance class.

Fig. 33

Supported flange ring



Mounting instructions

Cam followers can be attached to associated components (→ **fig. 33**) using the hexagonal nuts (→ **table 3**, **page 244**) supplied together with the cam follower. Spring washers, which are not supplied by SKF, serve to secure the nuts.

Cam followers that are subjected to shock loads should be mounted without clearance between the stud and its bore seat. The nuts should be tightened according to the recommended torque values listed in **table 3** on **page 244**. The recommended tightening torques enable the full load carrying capacity of the cam follower to be exploited. If the requisite tightening torque cannot be achieved, the stud should be mounted with an interference fit.

Most cam followers (all from size 22) have recessed hexagons and can be held with a hexagonal key (Allen wrench) while the nut is being tightened. Some designs of sizes 16 and 19 have a slot in the stud head end and can be held with a screwdriver. For additional information, refer to the illustrations in the product tables, starting on **page 252**.

Depending on the mounting conditions, cam followers with an eccentric collar can be adjusted to the required eccentricity via the slot or the recessed hexagon.

Do not hit the head of the stud as damage to the cam follower may result.

SKF recommends positioning the lubrication hole in the stud head in the unloaded zone of the cam follower. The position of this hole corresponds to the SKF trademark on the head end of the stud.

The lubrication hole (→ position 3 in **fig. 32**, **page 248**) that is in line with the lubrication hole in the stud head may be used to incorporate a locking device to prevent the stud from turning, or can be used for relubrication purposes. This is only possible with cam followers that do not have an eccentric collar and with KR design cam followers from size 30 and larger.

Supplementary designations

The designation suffixes used to identify certain features of SKF cam followers are explained in the following.

.2RS Contact seal of acrylonitrile-butadiene rubber (NBR) on both sides of the cam follower

A NUKR design cam followers with an improved crowned profile of the outer ring running surface

B KR design cam followers with a crowned profile of the outer ring running surface and a recessed hexagon on both ends of the stud

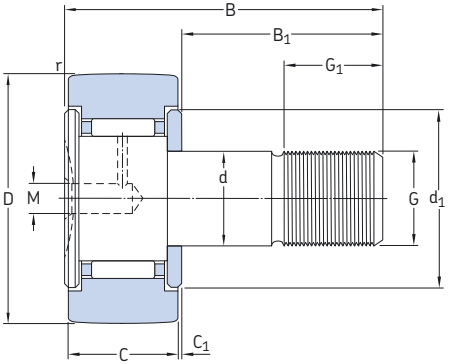
PPA KR design cam followers with a polyamide 66 axial sliding and sealing ring on both sides. Improved crowned profile of the outer ring running surface. Sizes 16 and 19 have one slot in the head of the stud as standard. Size 22 and larger have a recessed hexagon on both ends.

PPSKA KR design cam followers, sizes 16 and 19, with a polyamide 66 axial sliding and sealing ring on both sides, improved crowned profile of the outer ring running surface and hexagon recessed into the head of the stud. These cannot be relubricated.

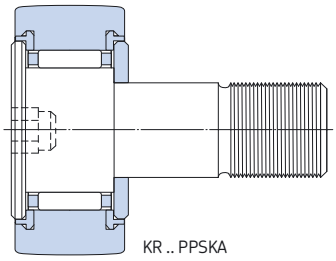
PPXA Cam followers with PPA features except for the outer ring running surface, which has a cylindrical profile

X Cylindrical (flat) profile of the outer ring running surface

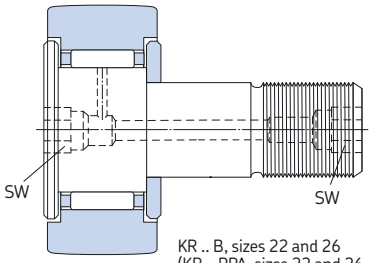
XA NUKR .. A and NUKRE .. A design cam followers with a cylindrical (flat) profile of the outer ring running surface



KR, sizes 16 and 19
(KR .. PPA, sizes 16 and 19
are with axial sliding rings)

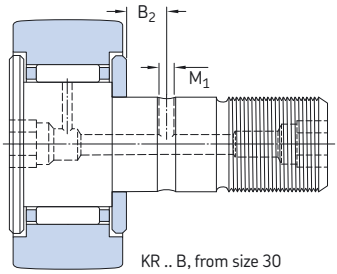


KR .. PPSKA

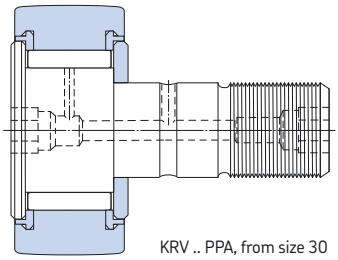


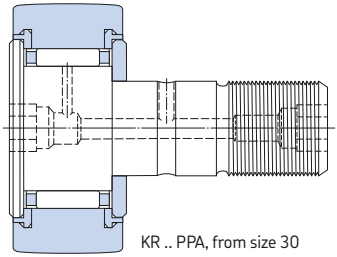
KR .. B, sizes 22 and 26
(KR .. PPA, sizes 22 and 26
are with axial sliding rings)

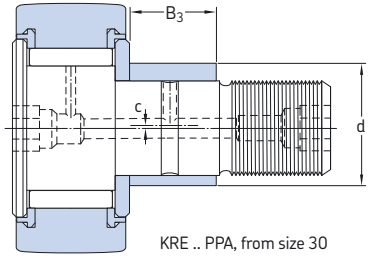
Dimensions																Mass	Designation
D	C	d	B	B_1	B_2	C_1	d_1	G	G_1	M	M_1	r min	SW	c	B_3		
mm																kg	–
16	11	6	28	16	–	0,6	12,5	M 6	8	4	–	0,15	–	–	–	0,018	**KR 16**
	11	6	28	16	–	0,6	12,5	M 6	8	4	–	0,15	–	–	–	0,018	**KR 16 PPA**
	11	6	28	16	–	0,6	12,5	M 6	8	–	–	0,15	4	–	–	0,018	**KR 16 PPSKA**
	11	6	28	16	–	0,6	12,5	M 6	8	4	–	0,15	–	–	–	0,019	**KRV 16 PPA**
	11	9	28	16	–	0,6	12,5	M 6	8	4	–	0,15	–	0,5	7	0,02	**KRE 16 PPA**
19	11	8	32	20	–	0,6	15	M 8	10	4	–	0,15	–	–	–	0,029	**KR 19**
	11	8	32	20	–	0,6	15	M 8	10	4	–	0,15	–	–	–	0,029	**KR 19 PPA**
	11	8	32	20	–	0,6	15	M 8	10	–	–	0,15	4	–	–	0,029	**KR 19 PPSKA**
	11	8	32	20	–	0,6	15	M 8	10	4	–	0,15	–	–	–	0,031	**KRV 19 PPA**
	11	11	32	20	–	0,6	15	M 8	10	4	–	0,15	–	0,5	9	0,032	**KRE 19 PPA**
22	12	10	36	23	–	0,6	17,5	M 10×1	12	–	–	0,3	5	–	–	0,045	**KR 22 B**
	12	10	36	23	–	0,6	17,5	M 10×1	12	–	–	0,3	5	–	–	0,043	**KR 22 PPA**
	12	10	36	23	–	0,6	17,5	M 10×1	12	–	–	0,3	5	–	–	0,045	**KRV 22 PPA**
	12	13	36	23	–	0,6	17,5	M 10×1	12	–	–	0,3	5	0,5	10	0,047	**KRE 22 PPA**
26	12	10	36	23	–	0,6	17,5	M 10×1	12	–	–	0,3	5	–	–	0,059	**KR 26 B**
	12	10	36	23	–	0,6	17,5	M 10×1	12	–	–	0,3	5	–	–	0,057	**KR 26 PPA**
	12	10	36	23	–	0,6	17,5	M 10×1	12	–	–	0,3	5	–	–	0,059	**KRV 26 PPA**
	12	13	36	23	–	0,6	17,5	M 10×1	12	–	–	0,3	5	0,5	10	0,062	**KRE 26 PPA**
30	14	12	40	25	6	0,6	23	M 12×1.5	13	–	3	0,6	6	–	–	0,092	**KR 30 B**
	14	12	40	25	6	0,6	23	M 12×1.5	13	–	3	0,6	6	–	–	0,088	**KR 30 PPA**
	14	12	40	25	6	0,6	23	M 12×1.5	13	–	3	0,6	6	–	–	0,091	**KRV 30 PPA**
	14	15	40	25	6	0,6	23	M 12×1.5	13	–	3	0,6	6	0,5	11	0,093	**KRE 30 PPA**
32	14	12	40	25	6	0,6	23	M 12×1.5	13	–	3	0,6	6	–	–	0,1	**KR 32 B**
	14	12	40	25	6	0,6	23	M 12×1.5	13	–	3	0,6	6	–	–	0,1	**KR 32 PPA**
	14	12	40	25	6	0,6	23	M 12×1.5	13	–	3	0,6	6	–	–	0,1	**KRV 32 PPA**
	14	15	40	25	6	0,6	23	M 12×1.5	13	–	3	0,6	6	0,5	11	0,1	**KRE 32 PPA**



KR .. B, from size 30

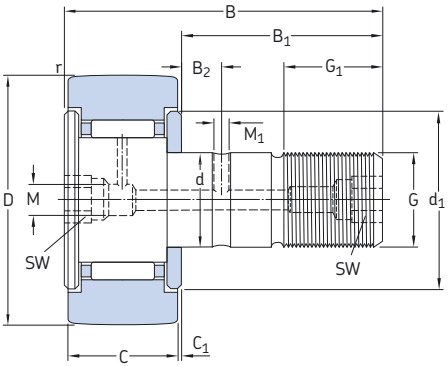

KRV .. PPA, from size 30


KR .. PPA, from size 30

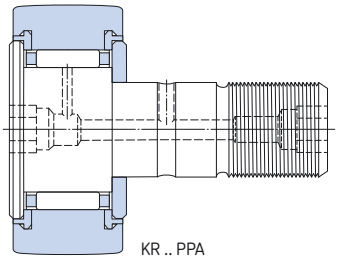


KRE .. PPA, from size 30

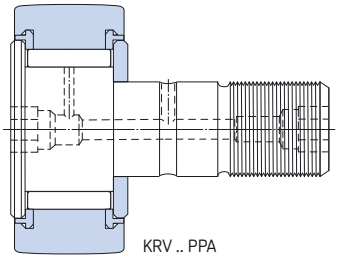
Designation	Basic load ratings dynamic	static	Fatigue load limit	Maximum radial loads dynamic	static	Limiting speed
	C	C_0	P_u	F_r	F_{0r}	
–	kN		kN	kN		r/min
KR 16	0,415	3,14	0,345	2,9	4,15	6 000
KR 16 PPA	0,415	3,14	0,345	2,9	4,15	6 000
KR 16 PPSKA	0,415	3,14	0,345	2,9	4,15	6 000
KRV 16 PPA	0,965	4,73	0,72	4,05	5,7	4 300
KRE 16 PPA	0,415	3,14	0,345	2,9	4,15	6 000
KR 19	0,51	3,47	0,415	3,8	5,5	5 600
KR 19 PPA	0,51	3,47	0,415	3,8	5,5	5 600
KR 19 PPSKA	0,51	3,47	0,415	3,8	5,5	5 600
KRV 19 PPA	1,22	5,28	0,88	5,1	7,35	4 000
KRE 19 PPA	0,51	3,47	0,415	3,8	5,5	5 600
KR 22 B	0,735	4,4	0,56	4,25	6	5 300
KR 22 PPA	0,735	4,4	0,56	4,25	6	5 300
KRV 22 PPA	1,5	6,05	1,04	5,7	8,15	3 600
KRE 22 PPA	0,735	4,4	0,56	4,25	6	5 300
KR 26 B	0,735	4,84	0,655	9,3	13,2	5 300
KR 26 PPA	0,735	4,84	0,655	9,3	13,2	5 300
KRV 26 PPA	1,5	6,82	1,25	11,4	16,3	3 600
KRE 26 PPA	0,735	4,84	0,655	9,3	13,2	5 300
KR 30 B	1,1	6,44	0,88	7,8	11,2	4 800
KR 30 PPA	1,1	6,44	0,88	7,8	11,2	4 800
KRV 30 PPA	2,2	8,97	1,66	11	15,6	3 200
KRE 30 PPA	1,1	6,44	0,88	7,8	11,2	4 800
KR 32 B	1,1	6,71	0,95	10,6	15	4 800
KR 32 PPA	1,1	6,71	0,95	10,6	15	4 800
KRV 32 PPA	2,2	9,35	1,76	14,3	20,4	3 200
KRE 32 PPA	1,1	6,71	0,95	10,6	15	4 800



KR .. B

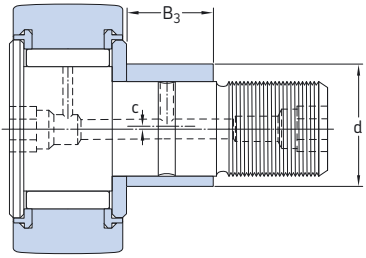


KR .. PPA

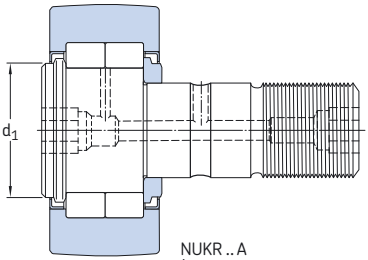


KRV .. PPA

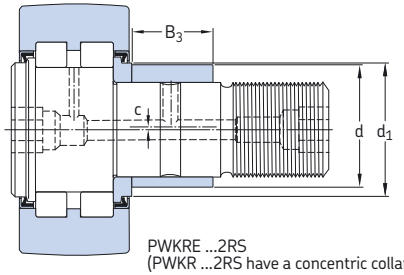
Dimensions																Mass	Designation
D	C	d	B	B_1	B_2	C_1	d_1	G	G_1	M	M_1	r min	SW	c	B_3		
mm																kg	–
35	18	16	52	32,5	8	0,8	27,6	M 16×1.5	17	–	3	0,6	8	–	–	0,17	**KR 35 B**
	18	16	52	32,5	8	0,8	27,6	M 16×1.5	17	–	3	0,6	8	–	–	0,16	**KR 35 PPA**
	18	16	52	32,5	8	0,8	27,6	M 16×1.5	17	–	3	0,6	8	–	–	0,17	**KRV 35 PPA**
	18	16	52	32,5	8	0,8	20	M 16×1.5	17	6	3	0,6	8	–	–	0,16	**NUKR 35 A**
	18	16	52	32,5	8	0,8	20	M 16×1.5	17	6	3	0,6	8	–	–	0,16	**PWKR 35.2RS**
	18	20	52	32,5	8	0,8	27,6	M 16×1.5	17	–	3	0,6	8	1	14	0,18	**KRE 35 PPA**
	18	20	52	29,5	8	3,8	27,6	M 16×1.5	17	6	3	0,6	8	1	12	0,18	**NUKRE 35 A**
	18	20	52	29,5	8	3,8	27,6	M 16×1.5	17	6	3	0,6	8	1	12	0,18	**PWKRE 35.2RS**
40	20	18	58	36,5	8	0,8	31,5	M 18×1.5	19	–	3	1	8	–	–	0,25	**KR 40 B**
	20	18	58	36,5	8	0,8	31,5	M 18×1.5	19	–	3	1	8	–	–	0,25	**KR 40 PPA**
	20	18	58	36,5	8	0,8	31,5	M 18×1.5	19	–	3	1	8	–	–	0,25	**KRV 40 PPA**
	20	18	58	36,5	8	0,8	22	M 18×1.5	19	6	3	1	8	–	–	0,24	**NUKR 40 A**
	20	18	58	36,5	8	0,8	22	M 18×1.5	19	6	3	1	8	–	–	0,24	**PWKR 40.2RS**
	20	22	58	36,5	8	0,8	31,5	M 18×1.5	19	–	3	1	8	1	16	0,26	**KRE 40 PPA**
	20	22	58	33,5	8	3,8	30	M 18×1.5	19	6	3	1	8	1	14	0,26	**NUKRE 40 A**
	20	22	58	33,5	8	3,8	30	M 18×1.5	19	6	3	1	8	1	14	0,26	**PWKRE 40.2RS**
47	24	20	66	40,5	9	0,8	36,5	M 20×1.5	21	8	4	1	10	–	–	0,38	**KR 47 PPA**
	24	20	66	40,5	9	0,8	36,5	M 20×1.5	21	8	4	1	10	–	–	0,39	**KRV 47 PPA**
	24	20	66	40,5	9	0,8	27	M 20×1.5	21	6	4	1	10	–	–	0,38	**NUKR 47 A**
	24	20	66	40,5	9	0,8	27	M 20×1.5	21	6	4	1	10	–	–	0,38	**PWKR 47.2RS**
	24	24	66	40,5	9	0,8	36,5	M 20×1.5	21	8	4	1	10	1	18	0,41	**KRE 47 PPA**
	24	24	66	40,5	9	0,8	27	M 20×1.5	21	6	4	1	10	1	18	0,4	**NUKRE 47 A**
	24	24	66	40,5	9	0,8	27	M 20×1.5	21	6	4	1	10	1	18	0,4	**PWKRE 47.2RS**
52	24	20	66	40,5	9	0,8	36,5	M 20×1.5	21	8	4	1	10	–	–	0,45	**KR 52 PPA**
	24	20	66	40,5	9	0,8	36,5	M 20×1.5	21	8	4	1	10	–	–	0,46	**KRV 52 PPA**
	24	20	66	40,5	9	0,8	31	M 20×1.5	21	8	4	1	10	–	–	0,45	**NUKR 52 A**
	24	20	66	40,5	9	0,8	31	M 20×1.5	21	8	4	1	10	–	–	0,45	**PWKR 52.2RS**
	24	24	66	40,5	9	0,8	36,5	M 20×1.5	21	8	4	1	10	1	18	0,47	**KRE 52 PPA**
	24	24	66	40,5	9	0,8	31	M 20×1.5	21	8	4	1	10	1	18	0,47	**NUKRE 52 A**
	24	24	66	40,5	9	0,8	31	M 20×1.5	21	8	4	1	10	1	18	0,47	**PWKRE 52.2RS**



KRE .. PPA

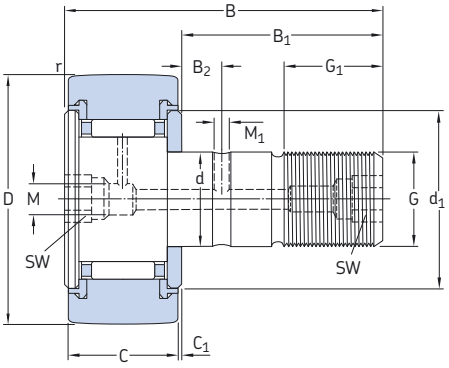


NUKR .. A
(NUKRE .. A have an eccentric collar)

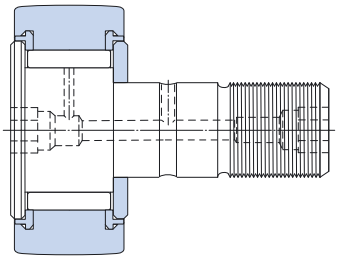


PWKRE ...2RS
(PWKR ...2RS have a concentric collar)

Designation	Basic load ratings dynamic C	static C_0	Fatigue load limit P_u	Maximum radial loads dynamic F_r	static F_{0r}	Limiting speed
–	kN		kN	kN		r/min
KR 35 B	2,2	9,52	1,56	11,4	16,3	4 000
KR 35 PPA	2,2	9,52	1,56	11,4	16,3	4 000
KRV 35 PPA	4,05	12,3	2,7	14,6	20,8	2 600
NUKR 35 A	3,25	16,8	2	8,65	12,2	5 000
PWKR 35.2RS	1,9	11,9	1,2	8,65	12,5	5 000
KRE 35 PPA	2,2	9,52	1,56	11,4	16,3	4 000
NUKRE 35 A	3,25	16,8	2	8,65	12,2	5 000
PWKRE 35.2RS	1,9	11,9	1,2	8,65	12,5	5 000
KR 40 B	2,4	10,5	1,73	12,5	18	3 400
KR 40 PPA	2,4	10,5	1,73	12,5	18	3 400
KRV 40 PPA	4,65	14,2	3,1	17	24,5	2 200
NUKR 40 A	3,65	19	2,5	14	20	4 500
PWKR 40.2RS	2,16	13,8	1,5	13,7	19,6	4 500
KRE 40 PPA	2,4	10,5	1,73	12,5	18	3 400
NUKRE 40 A	3,65	19	2,5	14	20	4 500
PWKRE 40.2RS	2,16	13,8	1,5	13,7	19,6	4 500
KR 47 PPA	3,8	14,7	2,9	23,6	33,5	3 000
KRV 47 PPA	7,2	19,4	5	30,5	43	1 900
NUKR 47 A	6	28,6	3,9	17,6	25	3 800
PWKR 47.2RS	4,3	22,9	2,8	18,3	26	3 800
KRE 47 PPA	3,8	14,7	2,9	23,6	33,5	3 000
NUKRE 47 A	6	28,6	3,9	17,6	25	3 800
PWKRE 47.2RS	4,3	22,9	2,8	18,3	26	3 800
KR 52 PPA	3,8	15,7	3,2	36	51	3 000
KRV 52 PPA	7,2	20,9	5,6	45	64	1 900
NUKR 52 A	7,2	29,7	4,25	18	25,5	3 200
PWKR 52.2RS	5,1	23,8	3,05	18,6	26,5	3 200
KRE 52 PPA	3,8	15,7	3,2	36	51	3 000
NUKRE 52 A	7,2	29,7	4,25	18	25,5	3 200
PWKRE 52.2RS	5,1	23,8	3,05	18,6	26,5	3 200

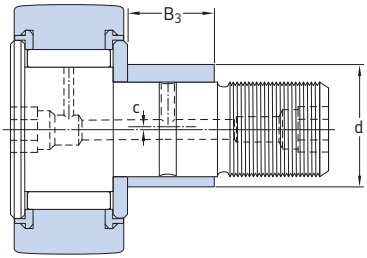


KR .. PPA

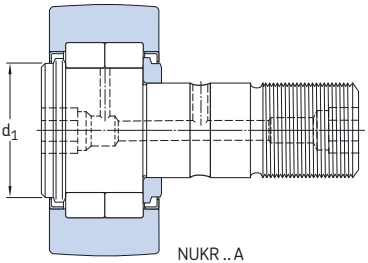


KRV .. PPA

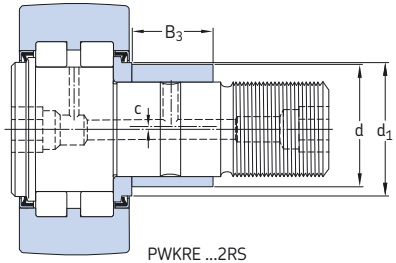
Dimensions																Mass	Designation
D	C	d	B	B_1	B_2	C_1	d_1	G	G_1	M	M_1	r min	SW	c	B_3		
mm																kg	–
62	29	24	80	49,5	11	0,8	44	M 24×1.5	25	8	4	1	14	–	–	0,77	**KR 62 PPA**
	29	24	80	49,5	11	0,8	44	M 24×1.5	25	8	4	1	14	–	–	0,79	**KRV 62 PPA**
	28	24	80	49,5	11	1,3	38	M 24×1.5	25	8	4	1	14	–	–	0,8	**NUKR 62 A**
	28	24	80	49,5	11	1,3	38	M 24×1.5	25	8	4	1	14	–	–	0,8	**PWKR 62.2RS**
	29	28	80	49,5	11	0,8	44	M 24×1.5	25	8	4	1	14	1	22	0,8	**KRE 62 PPA**
	28	28	80	49,5	11	1,3	38	M 24×1.5	25	8	4	1	14	1	22	0,82	**NUKRE 62 A**
	28	28	80	49,5	11	1,3	38	M 24×1.5	25	8	4	1	14	1	22	0,82	**PWKRE 62.2RS**
72	29	24	80	49,5	11	0,8	44	M 24×1.5	25	8	4	1,1	14	–	–	1,01	**KR 72 PPA**
	29	24	80	49,5	11	0,8	44	M 24×1.5	25	8	4	1,1	14	–	–	1,03	**KRV 72 PPA**
	28	24	80	49,5	11	1,3	44	M 24×1.5	25	8	4	1,1	14	–	–	1,02	**NUKR 72 A**
	28	24	80	49,5	11	1,3	44	M 24×1.5	25	8	4	1,1	14	–	–	1,02	**PWKR 72.2RS**
	29	28	80	49,5	11	0,8	44	M 24×1.5	25	8	4	1,1	14	1	22	1,04	**KRE 72 PPA**
	28	28	80	49,5	11	1,3	44	M 24×1.5	25	8	4	1,1	14	1	22	1,05	**NUKRE 72 A**
	28	28	80	49,5	11	1,3	44	M 24×1.5	25	8	4	1,1	14	1	22	1,05	**PWKRE 72.2RS**
80	35	30	100	63	15	1	53	M 30×1.5	32	8	4	1,1	14	–	–	1,61	**KR 80 PPA**
	35	30	100	63	15	1	53	M 30×1.5	32	8	4	1,1	14	–	–	1,64	**KRV 80 PPA**
	35	30	100	63	15	1	47	M 30×1.5	32	8	4	1,1	14	–	–	1,6	**NUKR 80 A**
	35	30	100	63	15	1	47	M 30×1.5	32	8	4	1,5	14	–	–	1,6	**PWKR 80.2RS**
	35	35	100	63	15	1	53	M 30×1.5	32	8	4	1,1	14	1,5	29	1,67	**KRE 80 PPA**
	35	35	100	63	15	1	47	M 30×1.5	32	8	4	1,1	14	1,5	29	1,67	**NUKRE 80 A**
	35	35	100	63	15	1	47	M 30×1.5	32	8	4	1,5	14	1,5	29	1,67	**PWKRE 80.2RS**
90	35	30	100	63	15	1	53	M 30×1.5	32	8	4	1,1	14	–	–	1,98	**KR 90 PPA**
	35	30	100	63	15	1	53	M 30×1.5	32	8	4	1,1	14	–	–	2	**KRV 90 PPA**
	35	30	100	63	15	1	47	M 30×1.5	32	8	4	1,1	14	–	–	1,96	**NUKR 90 A**
	35	30	100	63	15	1	47	M 30×1.5	32	8	4	1,5	14	–	–	1,96	**PWKR 90.2RS**
	35	35	100	63	15	1	53	M 30×1.5	32	8	4	1,1	14	1,5	29	2,03	**KRE 90 PPA**
	35	35	100	63	15	1	47	M 30×1.5	32	8	4	1,1	14	1,5	29	2,02	**NUKRE 90 A**
	35	35	100	63	15	1	47	M 30×1.5	32	8	4	1,5	14	1,5	29	2,02	**PWKRE 90.2RS**



KRE .. PPA



NUKR .. A
(NUKRE .. A have an eccentric collar)



PWKRE ...2RS
(PWKR ...2RS have a concentric collar)

Designation	Basic load ratings dynamic C	static C_0	Fatigue load limit P_u	Maximum radial loads dynamic F_r	static F_{0r}	Limiting speed
–	kN		kN	kN		r/min
KR 62 PPA	6,55	24,6	5,5	58,5	85	2 400
KRV 62 PPA	11,4	31,4	9	72	102	1 700
NUKR 62 A	9,5	41,3	5,85	25	36	2 600
PWKR 62.2RS	7,35	31,9	4,05	20,4	29	2 600
KRE 62 PPA	6,55	24,6	5,5	58,5	85	2 400
NUKRE 62 A	9,5	41,3	5,85	25	36	2 600
PWKRE 62.2RS	7,35	31,9	4,05	20,4	29	2 600
KR 72 PPA	6,55	26	6	100	143	2 400
KRV 72 PPA	11,4	33	9,8	118	170	1 700
NUKR 72 A	11,2	45,7	7,1	34,5	50	2 000
PWKR 72.2RS	7,35	39,6	5,6	47,5	68	2 600
KRE 72 PPA	6,55	26	6	100	143	2 400
NUKRE 72 A	11,2	45,7	7,1	34,5	50	2 000
PWKRE 72.2RS	7,35	39,6	5,6	47,5	68	2 600
KR 80 PPA	10,6	36,9	9	106	150	1 800
KRV 80 PPA	17,6	45,7	14	122	176	1 400
NUKR 80 A	16,6	69,3	10,8	48	69,5	1 900
PWKR 80.2RS	13,2	57,2	9,3	64	91,5	2 000
KRE 80 PPA	10,6	36,9	9	106	150	1 800
NUKRE 80 A	16,6	69,3	10,8	48	69,5	1 900
PWKRE 80.2RS	13,2	57,2	9,3	64	91,5	2 000
KR 90 PPA	10,6	38	9,5	160	228	1 800
KRV 90 PPA	17,6	47,3	15	183	260	1 400
NUKR 90 A	16,6	78,1	12,7	86,5	125	1 900
PWKR 90.2RS	13,2	62,7	10,8	108	153	2 000
KRE 90 PPA	10,6	38	9,5	160	228	1 800
NUKRE 90 A	16,6	78,1	12,7	86,5	125	1 900
PWKRE 90.2RS	13,2	62,7	10,8	108	153	2 000

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