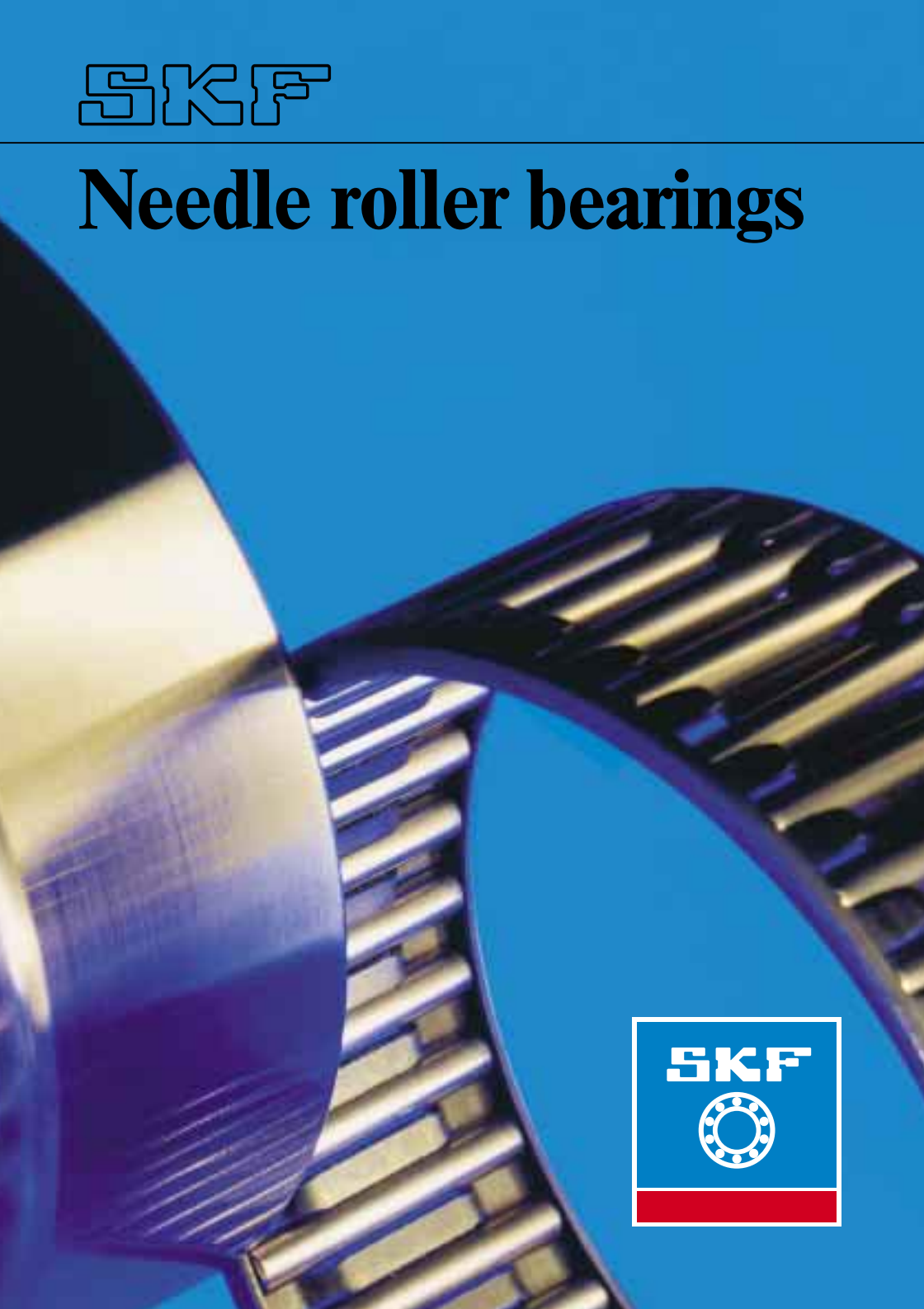
SKF

Needle roller bearings



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General

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The SKF Group – a worldwide corporation ..... **page 6**

Made by SKF® stands for excellence. It symbolises our consistent endeavour to achieve total quality in everything we do. For those who use our products, “Made by SKF” implies three main benefits.

Reliability – thanks to modern, efficient products, based on our worldwide application know-how, optimised materials, forward-looking designs and the most advanced production techniques.

Cost effectiveness – resulting from the favourable ratio between our product quality plus service facilities, and the purchase price of the product.

Market lead – which you can achieve by taking advantage of our products and services. Increased operating time and reduced down-time, as well as improved output and product quality are the key to a successful partnership.



Foreword

This catalogue gives a representative overview of the range of needle roller bearings and truck runner bearings available from SKF. Compared with the SKF catalogues 4001 and 4703, which it replaces, this catalogue contains considerable alterations and additions and the assortment has been brought up to date.

This catalogue contains all the data relevant to the needle roller and track runner bearings shown. The product tables contain all the data required to select a bearing and for the arrangement of the bearing. A description of the bearing type including design features and other information precedes each product table section. General data regarding speeds, bearing tolerances, internal clearance, materials, supplementary designations and also the design of associated components are included in the catalogue.

The catalogue is designed to enable the information regarding a particular product to be quickly and easily accessed. The contents are divided into four sections which are clearly identified.

The data shown in this catalogue is based on the state of the art in the end of 2000. Thus, compared with the previous catalogue data have been changed or added as a result of product redesign, or more recent computer calculations. The basic dynamic and static load ratings have been calculated according to the latest standards.

The right is reserved make any changes necessitated by the continuous improvement of the product with respect to materials, design and manufacture.

The units used in this catalogue are those specified in ISO 1000:1992, SI units (Système Internationale d'Unités).

The SKF Group – a worldwide corporation

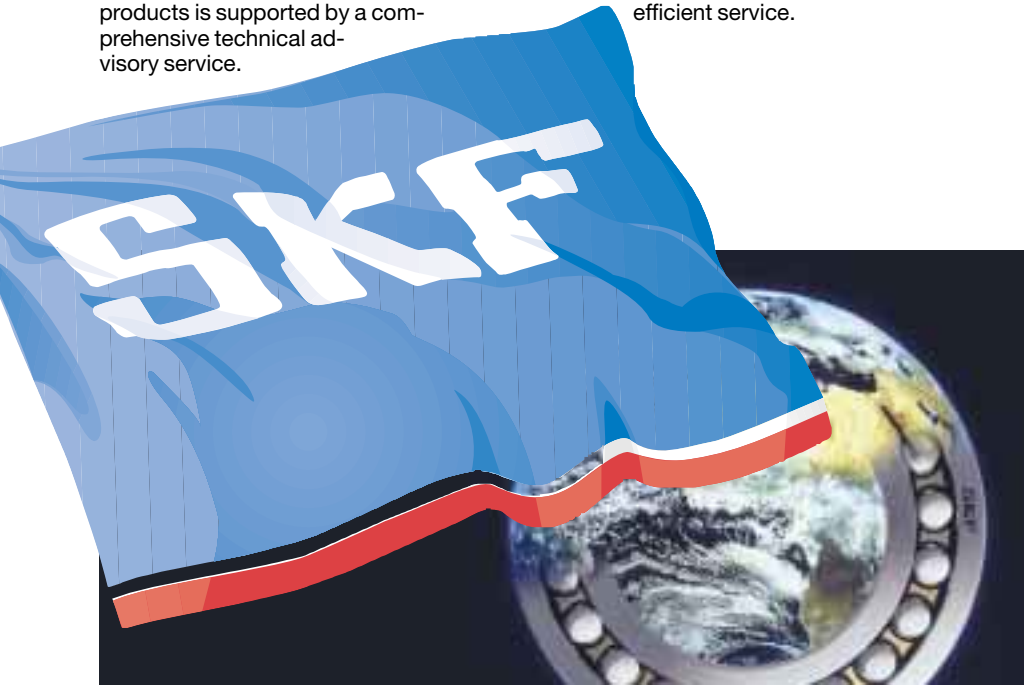
SKF is an international industrial Group operating in some 130 countries and is world leader in bearings.

The company was founded in 1907 following the invention of the self-aligning ball bearing by Sven Wingquist and, after only a few years, SKF began to expand all over the world.

Today, SKF has some 40 000 employees and around 80 manufacturing facilities spread throughout the world. An international sales network includes a large number of sales companies and some 7 000 distributors and retailers. Worldwide availability of SKF products is supported by a comprehensive technical advisory service.

The key to success has been a consistent emphasis on maintaining the highest quality of its products and services. Continuous investment in research and development has also played a vital role, resulting in many examples of epoch-making innovations.

The business of the Group consists of bearings, seals, special steel and a comprehensive range of other high-tech industrial components. The experience gained in these various fields provides SKF with the essential know-ledge and expertise required in order to provide the customers with the most advanced engineering products and efficient service.



The SKF Group is the first major bearing manufacturer to have been granted approval according to ISO 14001, the international standard for environmental management systems. The certificate is the most comprehensive of its kind and covers more than 60 SKF production units in 17 countries.



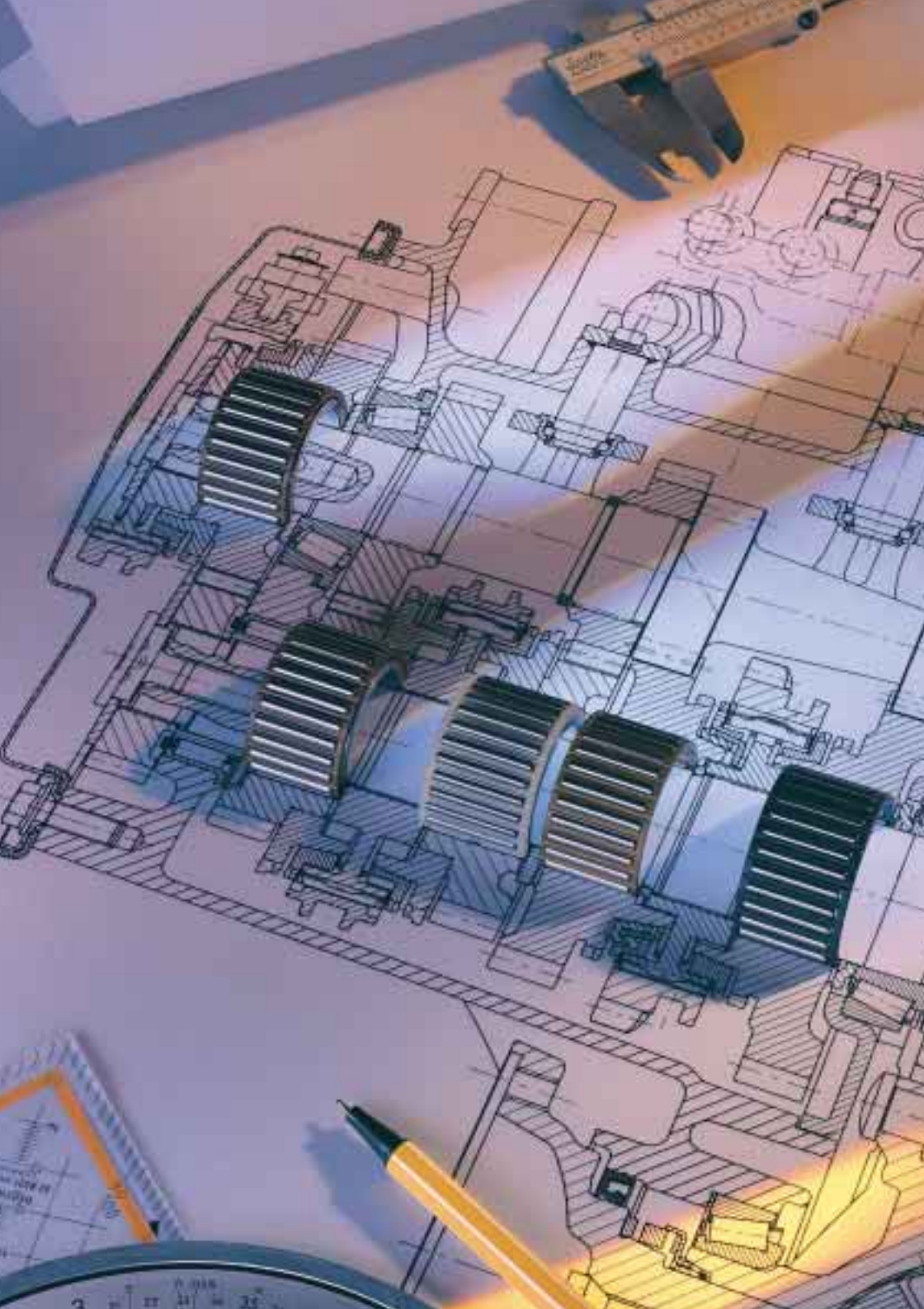
The SKF Engineering & Research Centre is situated just outside Utrecht in The Netherlands. In an area of 17 000 square metres (185 000 sq.ft) some 150 scientists, engineers and support staff are engaged in the further improvement of bearing peformance. They are developing technologies aimed at achieving better materials, better designs, better lubricants and better seals – together leading to an even better understanding of the operation of a bearing in its application. This is also where the SKF Life Theory was evolved, enabling the design of bearings which are even more compact and offer even longer operational life.



SKF has developed the Channel concept in factories all over the world. This drastically reduces the lead time from raw material to end product as well as work in progress and finished goods in stock. The concept enables faster and smoother information flow, eliminates bottlenecks and bypasses unnecessary steps in production. The Channel team members have the know-ledge and commitment needed to share the responsibility for fulfilling objectives in areas such as quality, delivery time, production flow etc.



SKF manufactures ball bearings, roller bearings and plain bearings. The smallest are just a few millimetres (a fraction of an inch) in diameter, the largest several metres. SKF also manufactures bearing and oil seals which prevent dirt from entering and lubricant from leaking out. SKF's subsidiaries CR and RFT S.p.A. are among the world's largest producers of seals.

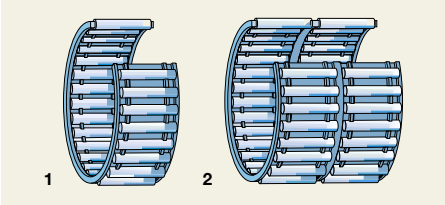


Bearing data

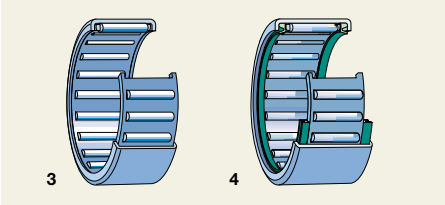
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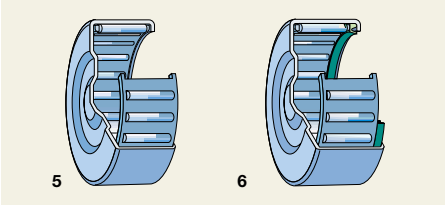
Bearing types



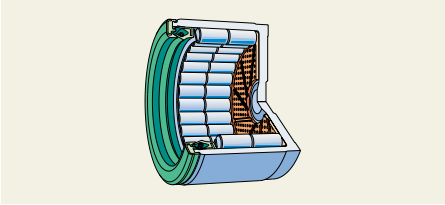
Needle roller and cage assemblies
single row (1)
double row (2)
split



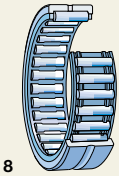
Drawn cup needle roller bearings with open ends
single row (3)
double row
single row, sealed at one side or both sides (4)



Drawn cup needle roller bearings with closed end
single row (5)
double row
single row, sealed (6)



universal joint bearings (7)

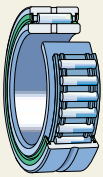


8

Needle roller bearings with flanges
without inner ring
- single row (8)
- double row
- with seals

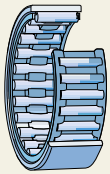


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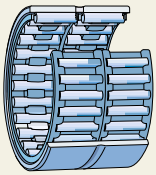


10

with inner ring
- single row (9)
- double row
- with seals (10)



11



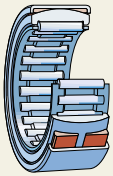
12

Needle roller bearings without flanges
without inner ring
- single row (11)
- double row (12)



13

with inner ring
- single row (13)
- double row

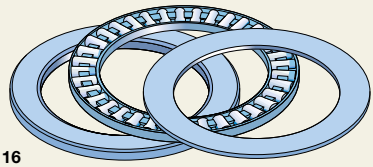


14



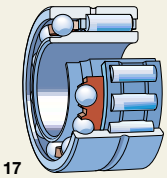
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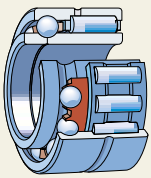
Alignment needle roller bearings
without inner ring (14)
with inner ring (15)



16

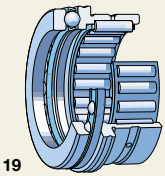
Needle roller thrust bearings
single direction
with (16) and without washers

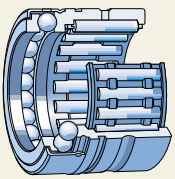

17


18

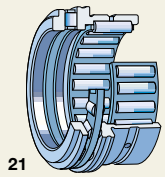
Combined needle roller bearings

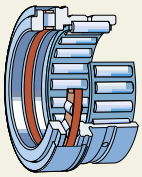
Needle roller/angular contact ball bearings
single direction (17)
double direction (18)


19

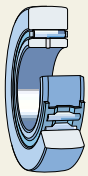

20

Needle roller/thrust ball bearings
without cover (19)
with cover
with full complement thrust ball bearing (20)

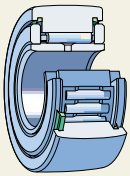

21


22

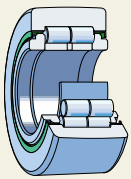
Needle roller/cylindrical roller thrust bearings
single direction
without cover (21)
with cover (22)


23

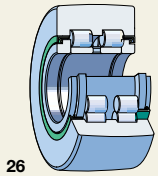
Support rollers without axial guidance
with and without seals
without inner ring
with inner ring (23)


24

Support rollers with axial guidance by thrust washers
with and without seals
caged (24)
full complement

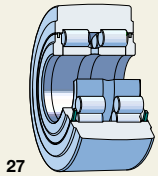


Support rollers with axial guidance by cylindrical rollers
with labyrinth seals (25)



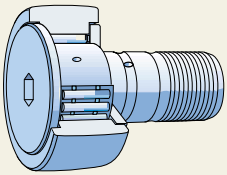
26

Support rollers with axial guidance by cylindrical rollers
with seals (26)



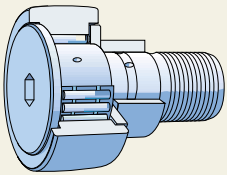
27

with lamellar seals (27)



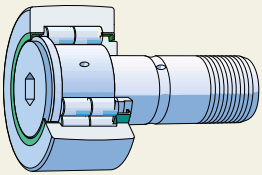
28

Cam followers with axial guidance by thrust plate
with (28) and without cage
with and without seals



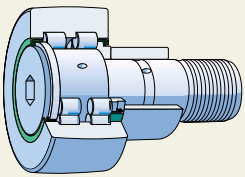
29

with (29) and without eccentric collar



30

Cam followers with axial guidance by cylindrical rollers
with labyrinth seals (30) or seals



31

with (31) and without eccentric collar

Bearing data – general

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Tolerances ..... **page 14**
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Speeds

The speed ratings given in the bearing tables may be exceeded up to 1,5 times the rating values for radial bearings and 2 times the rating values for thrust bearings provided loads are light, the friction minimised by using a minimum of lubricant and heat removal from the bearing position is good. Conversely, if loads are heavy, lubricant film formation inadequate, friction high because of excess or highly viscous lubricant, or when heat cannot be removed adequately from the bearing position, then it may not be possible to run at speeds as high as the values quoted for the speed ratings.

Reference should also be made to the section “Speeds” in the SKF General Catalogue.

Tolerances

Unless otherwise stated, the needle roller bearings shown in this catalogue are produced to the tolerances for dimensional, form and running accuracy specified in ISO 492:1994 for radial bearings and ISO 199:1997 for thrust bearings.

Tables 2 to 4 on **pages 17** to **19** give the tolerances for radial bearings to tolerance classes Normal, P6 and P5, and **Table** 5 on **page 20** gives the tolerances for thrust bearings to tolerance class Normal. The symbols used in the tables are explained opposite.

The tolerance classes in which bearings are available (either as standard, or additionally) will be found in the text preceding the product table sections. Bearings with higher accuracy than to tolerance class Normal are identified by the suffix for the tolerance class in the bearing designation (→ “Supplementary designations”, **page 24**). The suffix is preceded by an oblique stroke.

Tolerance symbols

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 single bore diameters in one plane
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 bore diameters of one ring or washer
B_s, C_s	single width of inner ring and outer ring, respectively
Δ_{Bs}, Δ_{Cs}	deviation of 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 inner ring and of outer ring, respectively
T_s	single height (H) of single direction thrust bearing
Δ_{Ts}	deviation of single height of thrust bearing from the nominal ($\Delta_{Ts} = T_s - T$)
K_{ia}, K_{ea}	radial runout of assembled bearing inner ring and assembled bearing outer ring, respectively
S_d	side face runout with reference to bore (of inner ring)
S_D	outside inclination variation; variation in inclination of outside cylindrical surface to outer ring side face
S_i, S_e	thickness variation, measured from middle of raceway to back (seating) face of shaft washer and of housing washer, respectively (axial runout)

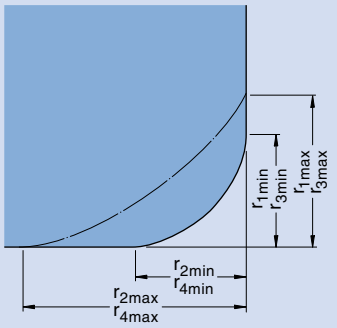
Limits for chamfer dimensions

To prevent the improper dimensioning of associated components for needle roller bearings and to facilitate the calculation of retaining ring location arrangements, the maximum chamfer limits for the relevant minimum chamfer dimensions given in the product tables will be found in **Table 1**. These limits conform to ISO 582:1995. The symbols used in the tables are explained below.

- d nominal bore diameter
- r_1, r_3 chamfer dimensions in radial direction
- r_2, r_4 chamfer dimensions in axial direction
- $r_{s\,min}$ general symbol for minimum limit of r_1, r_2, r_3, and r_4 (single chamfer dimension)

Table 1

Chamfer dimension limits



Minimum value	Nominal bearing bore diameter d		Maximum values Radial bearings		Thrust bearings
$r_{s\,min}$	over	incl.	$r_{1,3}$ max	$r_{2,4}$ max	$r_{1,2,3,4}$ 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

Normal tolerances for radial bearings

Inner ring

d		Δ_{dmp}		V_{dp}	V_{dmp}	Δ_{Bs}		V_{Bs}	K_{ia}
over	incl.	high	low	max	max	high	low	max	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
400	**500**	0	–45	56	34	0	–450	50	65

Outer ring

D		Δ_{Dmp}		V_{Dp}	V_{Dmp}	Δ_{Cs}, V_{Cs}	K_{ea}
over	incl.	high	low	max	max		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
500	**630**	0	–50	63	38		100

Table 3

Class P6 tolerances for radial bearings

Inner ring

d		Δ_{dmp}		V_{dp}	V_{dmp}	Δ_{Bs}		V_{Bs}	K_{ia}
over	incl.	high	low	max	max	high	low	max	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
400	**500**	0	–35	44	26	0	–450	45	35

Outer ring

D		Δ_{Dmp}		V_{Dp}	V_{Dmp}	Δ_{Cs}, V_{Cs}	K_{ea}
over	incl.	high	low	max	max		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
500	**630**	0	–38	48	29		50

Class P5 tolerances for radial bearings

Inner ring

d		Δ_{dmp}		V_{dp}	V_{dmp}	Δ_{Bs}		V_{Bs}	K_{ia}	S_d
over	incl.	high	low	max	max	high	low	max	max	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
400	**500**	0	–27	27	14	0	–450	18	17	18

Outer ring

D		Δ_{Dmp}		V_{Dp}	V_{Dmp}	Δ_{Cs}	V_{Cs}	K_{ea}	S_D
over	incl.	high	low	max	max		max	max	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})	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
500	**630**	0	–28	28	14		18	25	18

Table 5

Normal tolerances for thrust bearings

Shaft washer

d		Δ_{dmp}		V_{dp}	S_i	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] Not valid where thrust washers of series AS are used

Housing washer

D		Δ_{Dmp}		V_{Dp}	S_e
over	incl.	high	low	max	
mm		µm		µm	
18	**30**	0	–13	10	Values are
30	**50**	0	–16	12	identical to
50	**80**	0	–19	14	those for shaft washer
80	**120**	0	–22	17	of same
120	**180**	0	–25	19	bearing (S_i)
180	**250**	0	–30	23	

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 of a bearing before mounting and the internal clearance in a mounted bearing which has reached its operating temperature (operational clearance). The initial internal clearance (before mounting) is greater than the operational clearance because different degrees of interference in the fits and differences in thermal expansion of the bearing rings and the associated components cause the rings to be expanded or compressed.

The bearing internal clearance referred to as Normal has been selected so that a suitable operational clearance will be obtained when bearings are mounted with the fits usually recommended and operating conditions are normal. Where operating and mounting conditions differ from the normal, e.g. where interference fits are used for both bearing rings, unusual temperatures prevail etc., bearings with greater or smaller internal clearance than Normal are required. In such cases it is recommended that the residual clearance in the bearing after it has been mounted be checked.

SKF needle roller bearings with inner ring are supplied as standard with Normal radial internal clearance, unless otherwise stated. Bearings having an internal clearance other than Normal are identified by the suffixes C2, C3 and C4.

The limits for radial internal clearance correspond to ISO 5753:1991 and are given in **Table** 6.

Table 6

Radial internal clearance for needle roller bearings

Bore diameter d		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

Materials

Bearing rings and rolling elements
The rings and rolling elements of SKF needle roller bearings are made of a through-hardening carbon chromium steel to DIN 17 230:1980 containing approximately 1 % carbon and 1,5 % chromium. The thin-walled deep drawn outer rings of drawn cup and alignment needle roller bearings are exceptions to the above and are made of mild steel to DIN 17 230:1980.

All components are hardened and can generally be used at operating temperatures up to +125 °C. If the operating temperatures are higher, the bearings must be subjected to a special heat treatment (stabilisation) so that inadmissible changes in dimensions do not occur as a result of structural changes in the steel. However, the bearings should not be stabilised for a higher temperature than the expected operating temperature.

As the load carrying capacity of bearings decreases with increasing temperature, the basic dynamic load rating C should be multiplied by an appropriate reduction factor, see following.

Bearing temperature (°C)	150	200	250	300
Reduction factor	1,00	0,90	0,75	0,60

Cages
Various cage types and designs are used for the different types and sizes of SKF needle roller bearing types; the cages differ as to form, material, manufacturing methods, cost of production and operational limits. The standard cage for a particular bearing is not identified in the bearing designation unless it is of polyamide.

With reference to the viability of production, the costs and the different application areas of the bearings, the standard cage for the larger bearings may be different from that for the smaller bearings in one and the same series.

In the introductory text to each table section information is provided regarding the standard cages with which the bearings are fitted and also the possible alternatives.

Polyamide cages

Small and medium-sized bearings are fitted with moulded cages of heat-stabilised, glass fibre reinforced polyamide 6,6 as standard. This material is characterised by a favourable combination of strength and elasticity. The good sliding properties of the plastic on lubricated steel surfaces and the smoothness of the cage surfaces in contact with the rolling elements mean that little friction is produced by the cage so that heat generation and wear in the bearing are at a minimum. The low density of the material means that the inertia of the cage is small. The injection moulding process used to produce the cages allows functionally suitable designs to be realised. The excellent running properties of polyamide cages under lubricant starvation conditions permit continued operation of the bearing for a time without any risk of seizure and secondary damage.

When using bearings with polyamide cages the permissible operating temperatures for the material and its resistance to the lubricant used must be observed. At operating temperatures up to the values given in **Table** 7 for the various oils and greases which are used as bearing lubricants, cage properties are unaffected. If the permissible temperature is exceeded, the cage material will age, this process being accelerated the longer the cage is exposed to the excessive

temperature. Brief periods at up to 20 °C above the recommended maximum temperatures can be tolerated provided they are interspersed with longer periods at operating temperatures below the recommended values, and provided the maximum operating temperature for the lubricant is not exceeded. When operating temperatures are constantly above 120 °C, bearings fitted with metallic cages must be used. Polyamide cages are also unsuitable for operating temperatures below –40 °C as they lose their elasticity.

The organic solvents normally used to clean rolling bearings such as white spirit or trichlorethane do not affect cage properties, nor do dilute alkaline cleaners (e.g. soda) if they are at room temperature and the period during which they are in contact is short. The chlorofluorocarbons or ammonia used in refrigeration do not attack polyamide. In vacuum, polyamide cages become brittle because they become dehydrated.

Steel cages

The majority of SKF needle roller bearings are fitted with pressed cages of steel or sheet steel. These cages have relatively high strength and weigh little. They take up little space in the bearing and therefore allow adequate lubricant supply to the roller/raceway contacts.

The sheet steel cages are produced from deep drawing strip or tube. The joints are welded. To reduce friction and wear they may be hardened and surface treated.

The steel cages are produced from mild steel tube and have profiled surfaces.

Steel cages can be used at operating temperatures up to 300 °C. They are not affected by the mineral or synthetic oil-based lubricants normally used for rolling bearings, nor by the organic solvents used to clean bearings. There is a risk of corrosion where water is present.

Table 7

Permissible operating temperatures for cages of glass fibre reinforced polyamide 6,6 with various bearing lubricants

Lubricant	Permissible operating temperature[1]
–	°C
Mineral oils	
Oils without EP additives e.g. machine oils, hydraulic oils	120
EP oils e.g. industrial and automotive gearbox oils	110
EP oils e.g. rear axle and differential gear oils (automotive), hypoid gear oils	100
Synthetic oils	
Polyglycols, poly-α-olefins	120
Diesters, silicones	110
Greases	
Lithium base[2], polyurea, bentonite, calcium complex	120

[1] Measured on the outside surface of the outer ring
[2] For sodium and calcium base greases and other bearing greases with a maximum operating temperature below 120 °C, the maximum temperature for the polyamide cage is the same as the maximum operating temperature for the grease; otherwise the permissible maximum operating temperature is 120 °C

Supplementary designations

The complete designation for a needle roller bearing product consists of the basic designation, which identifies bearing type and size, as well as any supplementary designations in the form of suffixes. These suffixes identify design features which differ from the original standard design. The features are divided into groups and when more than one feature is to be identified, the appropriate suffixes appear in a given order. Those suffixes which are commonly used to identify certain features of SKF needle roller bearings are explained in the following.

AS Bearing with lubrication hole(s) in the outer ring; a figure following AS gives the number of holes

ASR Bearing with annular groove and lubrication hole(s) in the outer ring; a figure following ASR gives the number of holes

BF Needle roller with flat ends

BIR Profiled inner ring raceway

C2 Radial internal clearance smaller than Normal

C3 Radial internal clearance greater than Normal

C4 Radial internal clearance greater than C3

D Changed internal design of bearing of same type and size as original. Generally dropped after a certain changeover period, but may be retained where variants of the same type and size of bearing have to be distinguished

DS Split needle roller and cage assembly

DSTN DS + TN

EGS Inner ring with non-directionally ground raceway

FMA M-profile machined steel cage, outer ring centred

FPA Window-type steel cage (from single blank, with punched or reamed pockets), outer ring centred

GP Noise tested bearing

H Reduced tolerance for the inside diameter of the cage and roller assembly. The figures following the letter H indicate the tolerance limits in µm, e.g. H+20+27

HT.. Special grease for high temperatures (up to +130 °C); the two figures following HT identify the actual grease

IS Bearing with lubrication hole(s) in the inner ring; a figure following IS indicates the number of holes

ISR Bearing with annular groove and lubrication hole(s) in the inner ring; a figure following ISR indicates the number of holes

JPC Profiled, roller guided pressed sheet steel cage. Different designs are identified by a figure, e.g. J1PC

JPCS Welded JPC cage, example: K 100×108×30 ZWJPCS

M./M. Diameter tolerance of needle rollers (e.g. M2/M4 – diameter tolerance –2 to –4 µm)

MT.. Special grease for moderate temperatures (up to +110 °C); the two figures following MT identify the actual grease

N/M. Diameter tolerance of needle rollers (e.g. N/M4 – diameter tolerance 0 to –4 µm)

PP Seals at both sides of a support roller or cam follower

P4 Dimensional and running accuracy to ISO tolerance class 4 specifications (better than P5)

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)

P62 P6 + C2

P63 P6 + C3

RS Rubbing seal at one side of bearing

.2RS Rubbing seals at both sides of bearing

S Matched bearings for an equal distribution of radial load. A figure preceding the S indicates the number of bearings

SK Cam follower with internal hexagon at head side of stud

SM.. Bearing filled with a special grease; the two figures following SM identify the actual grease

/SORT Gauge of the needle rollers of an assembly. The figures following indicate the gauge limits in µm, e.g. KZK 18×24×13/SORT–1–3

S0 Bearing, the rings or washers of which have been stabilised for operating temperatures up to +150 °C

S1 Bearing, the rings or washers of which have been stabilised for operating temperatures up to +200 °C

S2 Bearing, the rings or washers of which have been stabilised for operating temperatures up to +250 °C

TN Injection moulded glass fibre reinforced polyamide 6,6 cage

V Full complement of rollers (no cage)

VGS Preground raceway on inner ring

X Support roller and cam follower with cylindrical runner surface on the outer ring instead of standard crowned runner surface

Z Bearing with cover

ZTN Z + TN

ZW Double row cage

ZWTN ZW + TN

2ZL Support roller with two lamellar seals arranged between grooves in the outer ring shoulders and in the shoulders of the non-integral flange rings

Design of associated components

Dimensional, form and running accuracy of bearing seatings and abutments

The accuracy of cylindrical bearing seatings on shafts and in housing bores, of seatings for thrust bearing washers and of the support surfaces (abutments for bearings provided by shaft and housing shoulders etc.) should correspond to the accuracy of the bearings used. In the following, guideline values for the dimensional, form and running accuracy are given. These should be followed when machining the seatings and abutments.

Dimensional tolerances

For bearings made to Normal tolerances, the dimensional accuracy of cylindrical seatings on the shaft should be at least to grade 6 and in the housing at least to grade 7. For bearings with higher accuracy, correspondingly better grades should be used. The basic tolerances to ISO 286-1:1988 will be found in **Table** 8.

Tolerances for cylindrical form

The cylindricity tolerances as defined in ISO 1101-1985 should be 1 to 2 IT grades better than the prescribed dimensional tolerance, depending on requirements. For example, if a bearing shaft seating has been machined to tolerance f6, then the accuracy of form should be to IT5 or IT4. **Table** 9 gives guideline values for the cylindrical form tolerance and the total runout tolerance for the different bearing tolerance classes.

Tolerances for perpendicularity

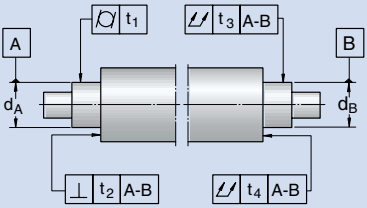
Abutments for bearing rings should have a rectangularity tolerance as defined in ISO 1101-1983 which is better by at least one IT grade than the diameter tolerance of the associated cylindrical seating. For thrust bearing washer seatings, the perpendicularity tolerance should not exceed the values of IT5. Guideline values for the rectangularity tolerance and for the total axial runout will be found in the **Table** 9.

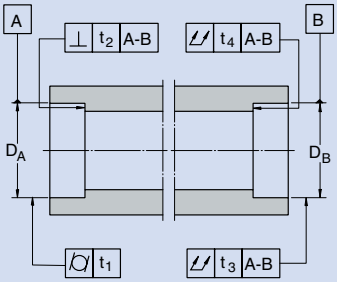
Table 8

Limits for ISO tolerance grades

Nominal dimension over	incl.	Tolerance grades IT2	IT3	IT4	IT5	IT6	IT7
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

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





Surface Characteristic	Symbol for characteristic	tolerance zone	Permissible deviation Bearings of tolerance class[1] Normal	P6	P5
Cylindrical seating					
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					
Rectangularity	⊥	t_2	IT5	IT4	IT3
Total axial runout	↗↗	t_4	IT5	IT4	IT3

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

Surface roughness of bearing seatings
The roughness of bearing seating surfaces does not have the same degree of influence on bearing performance as the dimensional, form and running accuracies. However, a desired interference fit is much more accurately obtained the smoother the mating surfaces. For less critical bearing arrangements relatively large surface roughnesses are permitted. For bearing arrangements where demands in respect of accuracy are high, guideline values for the mean surface roughness R_a are given in **Table** 10 for the different dimensional accuracies of the bearing seatings. These recommendations apply to ground seatings, which are normally assumed for shaft seatings.

Raceways on shafts and in housings
Raceways machined in associated components for

- needle roller and cage assemblies,
- drawn cup needle roller bearings,
- needle roller bearings having only one ring,
- combined needle roller bearings without inner ring,
- needle roller and cage thrust assemblies and
- support rollers without inner ring

must have a hardness of between 58 and 64 HRC if the load carrying capacity of the bearing or assembly is to be fully exploited.

Influence of raceway hardness

Raceways having a hardness under 58 HRC reduce the load carrying capacity of the bearing arrangement. This is taken into account by multiplying the basic dynamic load rating by a reduction factor f_c from **Table** 11.

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, lower hardness and rougher surfaces may be used.

For radial bearing arrangements,

- the out-of-round should not exceed 25 %, and
- the deviation from cylindrical form should not exceed 50 %,

of the actual diameter tolerance of the raceway.

The permissible axial runouts of raceways for the needle roller and cage thrust assemblies are the same as for the shaft and housing washers of thrust bearings (➔ **Table** 5, **page 20**).

Raceway materials

Suitable materials for the seatings include

- through-hardening steels to DIN 17 230: 1980, e.g. steel 100 Cr 6,
- case-hardening steels to DIN 17 210:1986 and 17 230:1980, e.g. 15 CrNi 6 or 16 MnCr 5, as well as
- steels for flame or induction hardening to DIN 17 212:1972 or DIN 17 230:1980, which can be partially hardened.

Table 10

Guideline values for surface roughness of bearing seatings

Diameter of seating d (D)		**Recommended R_a value for ground seatings** 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 case depth which is recommended 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, and it is difficult to generalise. 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 case depth is of the order of 0,1 times the rolling element diameter. Smaller case depths are permitted for dynamic loads. Please contact SKF for advice.

Table 11

Reduction factor f_c

Raceway hardness (HRC)	**Reduction factor f_c** for dynamic load conditions
55	0,7
50	0,5
45	0,4
40	0,3
35	0,25
30	0,2


SKF

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SKF

Needle roller and cage assemblies

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SKF needle roller and cage assemblies are ready-to-mount, self-contained, bearing arrangement components. They enable bearing arrangements to be produced which have high load carrying capacity and stiffness and require a minimum of radial space if the shaft and housing bore can serve as raceways and have the same hardness and surface finish as bearing rings. If the raceways are made with increased accuracy, bearing arrangements with high running accuracy can be achieved.

SKF needle roller and cage assemblies are available in single row (➔ **fig** 1) and double row (➔ **fig** 2) designs. They are characterised by

- simple and rugged design,
- accurate guidance of the rollers in the cage pockets, and
- good running properties.

The needle rollers are slightly relieved towards their ends. The modified line contact thus achieved between rollers and raceways means that damaging edge stresses are avoided.

Fig 1

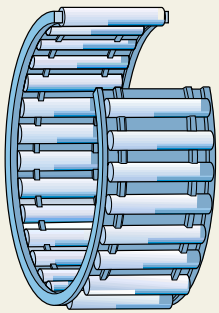


Fig 2

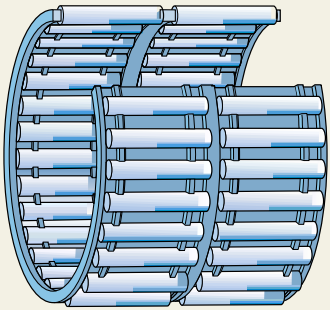


Fig 3

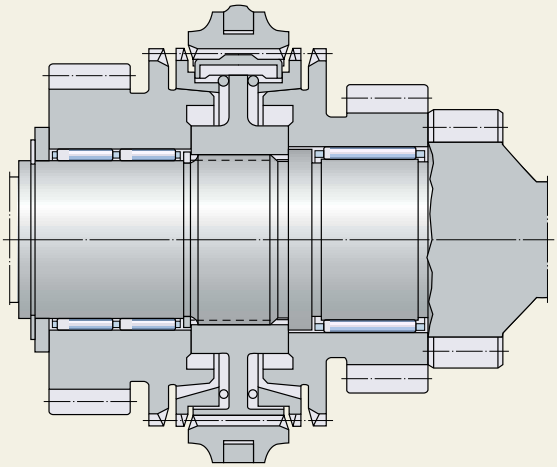


Fig 4

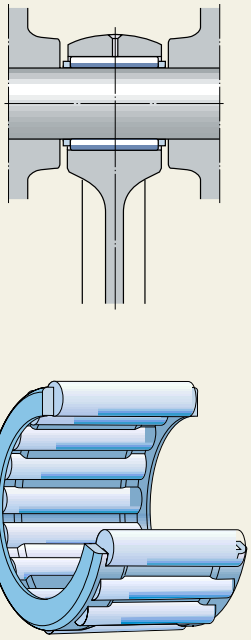
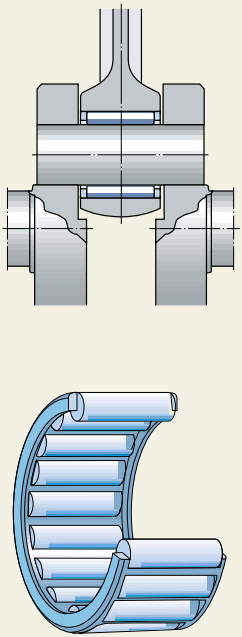


Fig 5



Other needle roller and cage assemblies

The needle roller and cage assemblies listed in the product tables form only a part of the comprehensive range available from SKF. This not only includes other sizes but also assemblies with cages which differ from the standard cage design, for example split needle roller and cage assemblies, which can be used where raceways are recessed in the shaft (→ **fig** 3).

For the connecting rod bearing arrangements of combustion engines and compressors, SKF has special needle roller and cage assemblies for gudgeon pin bearing arrangements (→ **fig** 4) and crankpin bearing arrangements (→ **fig** 5). The assemblies for these applications, where high accelerations occur, have given excellent service in spite of the difficult operating conditions, including high temperatures or unfavourable load, movement or lubrication conditions.

To special order, SKF also produces special sizes of needle roller and cage assemblies, when the quantities required are economical.

Details of these other needle roller and cage assemblies will be sent on request.

Dimensions

The dimensions of needle roller and cage assemblies with inside diameter up to and including 100 mm, where standardised, conform to ISO 3030:1996.

Tolerances

SKF needle roller and cage assemblies each contain rollers of one gauge of grade G2 (ISO 3096:1996 Grade 2). The tolerance of each gauge is 2 µm maximum. The relevant gauge is indicated by a coloured slip enclosed in the package (→ **Table** 1). The deviations from the nominal dimensions of the needle rollers are also printed on the package.

Supplies of needle roller and cage assemblies may comprise assemblies of any gauge (red, blue, white or grey) unless specific requirements are stated when ordering. Assemblies with rollers of special gauge (green and yellow) are only available to special order.

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

Paired mounting

If needle roller and cage assemblies are to be mounted immediately adjacent to each other, they must incorporate rollers of the same gauge, so that both assemblies carry the load equally.

Table 1

Needle roller gauges

Gauge type	Colour	Gauge in µm	
Standard gauges	red	0/–2	–1/–3
	blue	–2/–4	–3/–5
	white (grey)	–4/–6	–5/–7
Special gauges (to order)	green	–6/–8	–7/–9
	yellow	–8/–10	–9/–11

Internal clearance

The radial internal clearance of bearing arrangements incorporating needle roller and cage assemblies is determined by the gauge of the needle rollers in combination with the shaft and housing raceway tolerances and the operating temperature. Suitable raceway tolerances which have been well proven in practice are given in **Table 2**.

If applied when using assemblies incorporating rollers of standard gauge (➔ **Table 1**), the radial internal clearance will lie in the range of C2 and Normal (➔ **Table 6** on **page 21**).

If a specific radial internal clearance is required in a given bearing arrangement, it is recommended that the various components of the arrangement are matched, e.g. following a matching plan as shown in **Table 3**. It should be observed that the mean value of the needle roller gauge should be used to calculate the internal clearance, i.e. –6 µm for the gauge –5/–7 µm.

The example shown in **Table 3** will produce a small operational clearance, i.e. less than normal.

Misalignment

The modified line contact between the raceways and the needle rollers not only prevents damaging edge stresses, but also enables single row needle roller and cage assemblies to accept minimum misalignments up to approximately 1 minute of arc between shaft and housing.

Table 2

Raceway tolerances for needle roller and cage assemblies

Shaft Nominal diameter (mm) over	incl.	Tolerances housing/shaft for operational clearance less than normal	normal	greater than normal
–	80	G6/j5 H6/h5	G6/h5 H6/g5	G6/g6 H6/f6
80	140	G6/h5	G6/g5	G6/f6
140	–	G6/h5 –	G6/g5 H6/f5	G6/f6 H6/e6

Table 3

Matching plan

Needle roller and cage assembly: K 16×22×13
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
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	16–25
–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 have a steel (➔ **fig** 6) or sheet steel cage (➔ **fig** 7) as standard except for those identified by the designation suffix TN. These have an injection moulded glass fibre reinforced polyamide 6,6 cage (➔ **fig** 8).

NB.
Needle roller and cage assemblies with polyamide 6,6 cages can be used at temperatures up to +120 °C. With the exception of a few synthetic oils and greases with a synthetic base oil, and lubricants containing a high proportion of EP additives when used at high temperatures, the lubricants generally used for rolling bearings do not have a detrimental effect on cage properties.

For further information regarding the temperature resistance and use of cages, please refer to the section “Cages” (➔ **page 22**).

For bearing arrangements which are to be operated at continuously high temperatures or under arduous conditions, it is recommended that assemblies incorporating steel or sheet steel cages be used.

Raceways on the shaft and in the housing

If the full load carrying capacity of the needle roller and cage assembly is to be exploited the raceways on the shaft and in the housing must have the hardness and surface finish normally found on bearing raceways. Recommendations for suitable materials, surface roughness and hardness will be found in the section “Raceways on shafts and in housings” (➔ **page 28**).

Fig 6

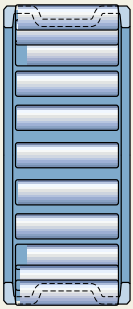
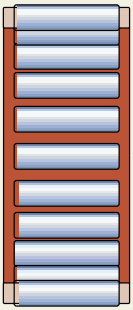


Fig 7



Fig 8



Abutment dimensions

Needle roller and cage assemblies must be axially guided. The lateral abutment surfaces should be fine turned and possibly polished; for high speed operation they should be hardened and ground. Interruptions in the surface should be avoided. Appropriate values for the abutment diameters on the shaft (➔ **fig** 9) and in the housing (➔ **fig** 10) are given in **Table** 4. Snap rings may be used in less demanding applications, otherwise an intermediate ring, e.g. a pressed spring steel washer should be placed between the snap ring and the assembly.

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	–	$E_w - 1$	$F_w + 1$

Fig 9

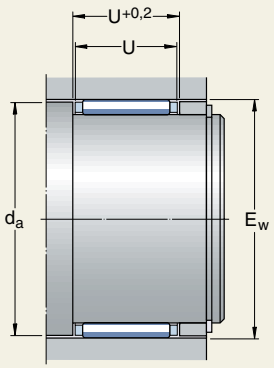
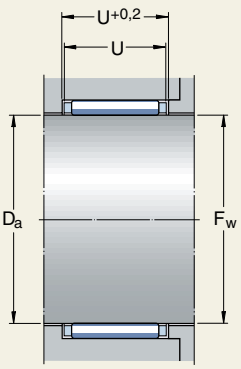


Fig 10



Minimum load
In order to guarantee satisfactory operation, needle roller and cage assemblies, like all ball and roller bearings, must always be subjected to a given minimum load, particularly if they are to operate at high speeds or are subjected to high accelerations or rapid changes in the direction of load. Under such conditions the inertia forces of the needle rollers and cage of the assembly, and the friction in the lubricant, can have a detrimental influence on the rolling conditions in the bearing arrangement and may cause damaging sliding movements to occur between the rollers and raceways.

The requisite minimum radial load to be applied to needle roller and cage assemblies can be estimated using

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

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

When starting up at low temperatures or when the lubricant is highly viscous, even greater loads may be required. The weights of the components supported by the bearing, together with the external forces, generally exceed the requisite minimum load. If this is not the case, the needle roller and cage assembly must be subjected to an additional radial load.

Equivalent dynamic bearing load
Needle roller and cage assemblies can only take radial loads, therefore

$$P = F_r$$

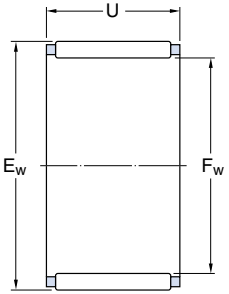
Equivalent static bearing load
Needle roller and cage assemblies can only take radial loads, therefore

$$P_0 = F_r$$

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
DSTN	DS + TN
SORT	Gauge of the needle rollers of an assembly. The figures following indicate the gauge limits in µm, e.g. SORT–1–3
TN	Injection moulded cage of glass fibre reinforced polyamide 6,6
VG052	Split cage of polyether ether ketone (PEEK)
ZW	Double row cage
ZWDSTN	ZW + DS + TN

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



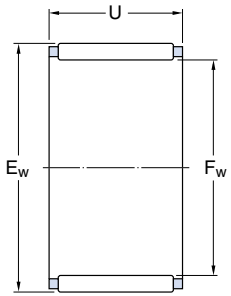
Dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Lubrication grease	oil	Mass	Designation	Appropriate seal[1] Designation
F_w	E_w	U	C	C_0	P_u					
mm			N		N	r/min		g	–	–
3	5	7	1 510	1 340	134	28 000	40 000	0,3	**K 3×5×7 TN**	–
	5	9	1 720	1 630	170	28 000	40 000	0,4	**K 3×5×9 TN**	–
	6	7	1 420	1 020	104	28 000	40 000	0,4	**K 3×6×7 TN**	–
4	7	7	1 720	1 320	137	24 000	36 000	0,5	**K 4×7×7 TN**	–
	7	10	2 290	1 900	204	24 000	36 000	0,7	**K 4×7×10 TN**	–
5	8	8	2 290	2 000	212	24 000	36 000	0,7	**K 5×8×8 TN**	–
	8	10	2 920	2 700	290	24 000	36 000	0,9	**K 5×8×10 TN**	–
6	9	8	2 550	2 360	250	22 000	34 000	0,8	**K 6×9×8 TN**	–
	9	10	3 300	3 200	345	22 000	34 000	1,1	**K 6×9×10 TN**	–
	10	13	3 690	3 150	360	22 000	34 000	1,9	**K 6×10×13 TN**	G 6×10×2 S
7	9	7	1 680	1 830	190	22 000	34 000	0,6	**K 7×9×7 TN**	–
	10	8	2 810	2 750	290	20 000	32 000	0,9	**K 7×10×8 TN**	–
	10	10	3 580	3 750	415	20 000	32 000	1,0	**K 7×10×10 TN**	–
8	11	8	3 030	3 100	335	20 000	32 000	1,0	**K 8×11×8 TN**	–
	11	10	3 800	4 250	465	20 000	32 000	1,2	**K 8×11×10 TN**	–
	11	13	5 010	5 850	670	20 000	32 000	1,7	**K 8×11×13 TN**	–
	12	10	4 840	4 750	540	19 000	30 000	2,0	**K 8×12×10 TN**	G 8×12×3
9	12	10	4 400	5 200	570	19 000	30 000	1,5	**K 9×12×10 TN**	–
	12	13	5 720	7 200	815	19 000	30 000	2,1	**K 9×12×13 TN**	–
10	13	10	4 570	5 700	630	18 000	28 000	1,6	**K 10×13×10 TN**	–
	13	13	5 940	8 000	900	18 000	28 000	2,3	**K 10×13×13 TN**	–
	13	16	6 820	9 500	1 080	18 000	28 000	2,9	**K 10×13×16 TN**	–
	14	10	5 610	6 100	695	18 000	28 000	2,5	**K 10×14×10 TN**	G 10×14×3
	14	13	5 830	6 300	720	18 000	28 000	4,6	**K 10×14×13 TN**	G 10×14×3
	16	12	7 650	7 200	850	18 000	28 000	5,5	**K 10×16×12 TN**	–
12	15	10	4 730	6 200	695	17 000	26 000	1,9	**K 12×15×10 TN**	–
	15	13	6 160	8 650	980	17 000	26 000	2,3	**K 12×15×13 TN**	G 12×16×3
	16	13	7 650	9 500	1 100	17 000	26 000	3,6	**K 12×16×13 TN**	G 12×16×3
	17	13	9 130	10 400	1 220	17 000	26 000	4,9	**K 12×17×13 TN**	–
	18	12	9 520	10 000	1 180	17 000	26 000	6,0	**K 12×18×12 TN**	G/SD 12×18×3

[1] Details of appropriate seals will be found in the section "Seals" (→ **page 214**)

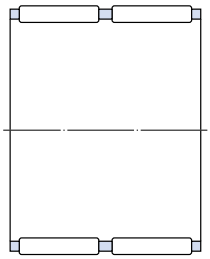
Dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Lubrication grease	oil	Mass	Designation	Appropriate seal[1] Designation
F_w	E_w	U	C	C_0	P_u					
mm			N		N	r/min		g	–	–
14	18	10	6 930	8 650	1 000	16 000	24 000	4,0	**K 14×18×10**	–
	18	13	7 920	10 200	1 180	16 000	24 000	6,5	**K 14×18×13**	–
	18	17	10 500	14 600	1 700	16 000	24 000	8,0	**K 14×18×17**	–
	20	12	9 900	10 600	1 250	16 000	24 000	8,1	**K 14×20×12**	G/SD 14×20×3
15	18	17	7 650	12 200	1 400	16 000	24 000	4,6	**K 15×18×17 TN**	–
	19	10	7 210	9 300	1 060	16 000	24 000	5,0	**K 15×19×10**	–
	19	13	8 250	11 200	1 290	16 000	24 000	7,0	**K 15×19×13**	–
	19	17	10 800	15 600	1 860	16 000	24 000	9,5	**K 15×19×17**	–
	20	13	9 520	11 600	1 340	16 000	24 000	7,0	**K 15×20×13**	–
	21	15	13 800	16 300	2 000	16 000	24 000	11	**K 15×21×15**	G/SD 15×21×3
	21	21	18 700	24 500	3 000	16 000	24 000	17	**K 15×21×21**	G/SD 15×21×3
16	20	10	7 480	10 000	1 160	16 000	24 000	5,5	**K 16×20×10**	–
	20	13	8 580	12 000	1 370	16 000	24 000	7,5	**K 16×20×13**	–
	20	17	11 200	17 000	2 000	16 000	24 000	10	**K 16×20×17**	–
	22	12	11 000	12 500	1 500	15 000	22 000	10	**K 16×22×12**	G/SD 16×22×3
	22	16	14 200	17 600	2 120	15 000	22 000	12	**K 16×22×16**	G/SD 16×22×3
	22	20	17 600	22 800	2 800	15 000	22 000	17	**K 16×22×20**	G/SD 16×22×3
	24	20	20 500	23 600	2 900	15 000	22 000	22	**K 16×24×20**	G/SD 16×24×3
17	21	10	7 810	10 800	1 220	15 000	22 000	5,5	**K 17×21×10**	–
	21	13	10 100	14 600	1 730	15 000	22 000	6,5	**K 17×21×13**	–
	21	17	11 700	18 300	2 120	15 000	22 000	9,5	**K 17×21×17**	–
18	22	10	8 090	11 400	1 320	15 000	22 000	6,0	**K 18×22×10**	–
	22	13	8 800	12 900	1 500	15 000	22 000	8,0	**K 18×22×13**	–
	22	17	11 700	18 300	2 160	15 000	22 000	11	**K 18×22×17**	–
	24	12	12 100	15 000	1 800	14 000	20 000	12	**K 18×24×12**	G/SD 18×24×3
	24	13	12 500	15 300	1 860	14000	20 000	13	**K 18×24×13**	G/SD 18×24×3
	24	20	19 400	27 000	3 250	14 000	20 000	18	**K 18×24×20**	G/SD 18×24×3
	25	22	22 000	29 000	3 550	14 000	20 000	23	**K 18×25×22**	–
	28	16	18 700	18 600	2 280	13 000	19 000	24	**K 18×28×16**	–
19	23	13	9 130	13 700	1 600	14 000	20 000	8,0	**K 19×23×13**	–
	23	17	12 100	19 300	2 280	14 000	20 000	11	**K 19×23×17**	–

[1] Details of appropriate seals will be found in the section "Seals" (→ **page 214**)

Needle roller and cage assemblies
F_w **20 – 37** mm



Serie K



Serie K .. ZW

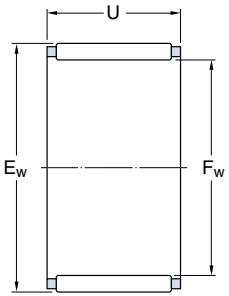
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F_w	E_w	U	C	C_0	P_u					
mm			N		N	r/min		g	–	–
20	24	10	8 580	12 900	1 460	14 000	20 000	6,5	**K 20×24×10**	–
	24	13	9 520	14 600	1 660	14 000	20 000	9,0	**K 20×24×13**	–
	24	17	12 500	20 800	2 400	14 000	20 000	12	**K 20×24×17**	–
	26	12	12 800	16 300	1 960	13 000	19 000	11	**K 20×26×12**	G/SD 20×26×4
	26	13	13 800	18 000	2 160	13 000	19 000	12	**K 20×26×13**	G/SD 20×26×4
	26	17	18 300	26 000	3 200	13 000	19 000	16	**K 20×26×17**	G/SD 20×26×4
	26	20	20 100	29 000	3 600	13 000	19 000	19	**K 20×26×20**	G/SD 20×26×4
	28	20	22 900	28 500	3 450	12 000	18 000	27	**K 20×28×20**	G/SD 20×28×4
	28	25	29 200	39 000	4 900	12 000	18 000	32	**K 20×28×25**	G/SD 20×28×4
	30	30	34 100	41 500	5 200	11 000	17 000	49	**K 20×30×30**	–
21	25	13	9 680	15 300	1760	13 000	19 000	9,0	**K 21×25×13**	–
22	26	10	8 800	13 700	1 560	12 000	18 000	7,5	**K 22×26×10**	–
	26	13	10 100	16 300	1 860	12 000	18 000	9,5	**K 22×26×13**	–
	26	17	13 200	22 800	2 700	12 000	18 000	12	**K 22×26×17**	–
	28	17	18 300	27 000	3 250	11 000	17 000	18	**K 22×28×17**	G/SD 22×28×4
	29	16	19 400	25 500	3 050	11 000	17 000	16	**K 22×29×16**	–
	30	15	19 000	23 600	2 800	11 000	17 000	18	**K 22×30×15 TN**	G/SD 22×30×4
23	35	16	24 200	23 200	2 900	9 500	15 000	29	**K 23×35×16 TN**	–
24	28	10	9 350	15 000	1 730	11 000	17 000	8,5	**K 24×28×10**	–
	28	13	10 600	18 000	2 080	11 000	17 000	10	**K 24×28×13**	–
	28	17	14 000	25 500	3 000	11 000	17 000	13	**K 24×28×17**	–
	30	17	18 700	27 500	3 400	10 000	16 000	19	**K 24×30×17**	–
	30	31	26 400	43 000	5 300	10 000	16 000	32	**K 24×30×31 ZW**	–
25	29	10	9 520	15 600	1 800	10 000	16 000	8,5	**K 25×29×10**	–
	29	13	10 800	18 600	2 160	10 000	16 000	11	**K 25×29×13**	–
	29	17	14 200	26 500	3 100	10 000	16 000	14	**K 25×29×17**	–
	30	17	17 900	30 500	3 600	10 000	16 000	16	**K 25×30×17**	–
	30	20	20 900	36 500	4 400	10 000	16 000	18	**K 25×30×20**	–
	30	26	20 500	36 000	4 150	10 000	16 000	19	**K 25×30×26 ZW**	–
	31	17	18 700	28 500	3 450	10 000	16 000	19	**K 25×31×17**	–
	31	21	23 300	38 000	4 750	10 000	16 000	20	**K 25×31×21**	–
	32	16	19 800	27 500	3 350	9 500	15 000	21	**K 25×32×16**	G 25×32×4
	33	20	27 500	38 000	4 650	9 500	15 000	33	**K 25×33×20**	G 25×33×4
	33	24	31 900	47 500	5 850	9 500	15 000	39	**K 25×33×24**	G 25×33×4
	35	30	44 600	62 000	7 800	9 500	15 000	65	**K 25×35×30**	G/SD 25×35×4

[1] Details of appropriate seals will be found in the section "Seals" (→ **page 214**)

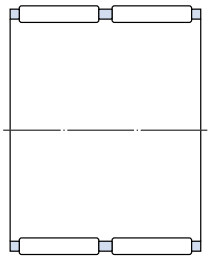
Dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Lubrication grease	oil	Mass	Designation	Appropriate seal[1] Designation
F_w	E_w	U	C	C_0	P_u					
mm			N		N	r/min		g	–	–
26	30	13	11 200	19 600	2 280	10 000	16 000	11	**K 26×30×13**	–
	30	17	14 700	27 500	3 250	10 000	16 000	15	**K 26×30×17**	–
	30	22	15 100	29 000	3 350	10 000	16 000	12	**K 26×30×22 ZW**	–
28	33	13	14 700	24 500	2 850	9 000	14 000	13	**K 28×33×13**	–
	33	17	19 000	33 500	4 050	9 000	14 000	17	**K 28×33×17**	–
	34	17	20 900	33 500	4 150	9 000	14 000	24	**K 28×34×17**	–
	35	16	20 500	30 000	3 550	9 000	14 000	24	**K 28×35×16**	G/SD 28×35×4
	35	18	22 900	34 500	4 150	9 000	14 000	27	**K 28×35×18**	G/SD 28×35×4
30	34	13	11 900	22 000	2 550	9 000	14 000	14	**K 30×34×13**	–
	35	13	15 100	25 500	3 000	8 500	13 000	14	**K 30×35×13**	–
	35	17	18 700	34 000	4 050	8 500	13 000	19	**K 30×35×17**	–
	35	27	29 200	60 000	7 350	8 500	13 000	30	**K 30×35×27**	–
	37	16	22 000	33 500	4 000	8 500	13 000	27	**K 30×37×16**	G/SD 30×37×4
	37	18	25 100	39 000	4 650	8 500	13 000	30	**K 30×37×18**	G/SD 30×37×4
	40	18	30 300	40 000	4 900	8 000	12 000	48	**K 30×40×18**	G/SD 30×40×4
	40	30	46 800	69 500	8 650	8 000	12 000	73	**K 30×40×30**	G/SD 30×40×4
32	37	13	14 700	25 500	3 000	8 500	13 000	18	**K 32×37×13**	–
	37	17	19 000	35 500	4 250	8 500	13 000	19	**K 32×37×17**	–
	37	27	28 600	60 000	7 350	8 500	13 000	30	**K 32×37×27**	–
	38	20	25 100	45 000	5 600	8 000	12 000	30	**K 32×38×20**	–
	39	16	22 900	35 500	4 250	8 000	12 000	37	**K 32×39×16**	–
	39	18	25 500	41 500	5 000	8 000	12 000	31	**K 32×39×18**	–
	40	25	35 800	58 500	7 200	8 000	12 000	49	**K 32×40×25**	–
35	40	13	15 400	28 000	3 250	8 000	12 000	19	**K 35×40×13**	–
	40	17	19 800	39 000	4 650	8 000	12 000	21	**K 35×40×17**	–
	40	25	28 100	60 000	7 350	8 000	12 000	31	**K 35×40×25**	–
	40	27	23 800	49 000	6 000	8 000	12 000	39	**K 35×40×27 TN**	–
	42	16	23 300	37 500	4 500	7 500	11 000	34	**K 35×42×16**	G/SD 35×42×4
	42	18	26 400	44 000	5 300	7 500	11 000	34	**K 35×42×18**	G/SD 35×42×4
	42	20	29 200	50 000	6 000	7 500	11 000	37	**K 35×42×20**	G/SD 35×42×4
	42	30	37 400	68 000	8 500	7 500	11 000	67	**K 35×42×30**	G/SD 35×42×4
	45	20	35 200	50 000	6 200	7 500	11 000	56	**K 35×45×20**	G/SD 35×45×4
37	42	17	21 600	43 000	5 200	7 500	11 000	22	**K 37×42×17**	–
	45	26	41 800	75 000	9 300	7 500	11 000	61	**K 37×45×26**	–

[1] Details of appropriate seals will be found in the section “Seals” (→ **page 214**)

Needle roller and cage assemblies
F_w **38 – 65** mm



Series K



Series K .. ZW

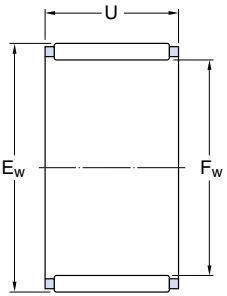
Dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Lubrication grease	oil	Mass	Designation	Appropriate seal[1] Designation
F_w	E_w	U	C	C_0	P_u					
mm			N		N	r/min		g	–	–
38	43	17	19 800	39 000	4 650	7 500	11 000	29	**K 38×43×17**	–
	43	27	30 300	68 000	8 300	7 500	11 000	43	**K 38×43×27**	–
	46	20	34 100	57 000	6 950	7 000	10 000	47	**K 38×46×20**	–
	46	32	52 300	100 000	12 500	7 000	10 000	76	**K 38×46×32**	–
39	44	26	26 000	57 000	6 700	7 000	10 000	45	**K 39×44×26 ZW**	–
40	45	13	16 800	32 500	3 800	7 000	10 000	22	**K 40×45×13**	–
	45	17	20 500	41 500	5 000	7 000	10 000	31	**K 40×45×17**	–
	45	27	31 400	73 500	9 000	7 000	10 000	46	**K 40×45×27**	–
	47	18	28 600	50 000	6 100	7 000	10 000	39	**K 40×47×18**	G/SD 40×47×4
	48	20	34 700	58 500	7 350	7 000	10 000	49	**K 40×48×20**	–
42	47	13	17 200	33 500	4 000	7 000	10 000	18	**K 42×47×13**	–
	47	17	20 900	43 000	5 200	7 000	10 000	32	**K 42×47×17**	–
	47	30	31 900	76 500	9 000	7 000	10 000	54	**K 42×47×30 ZW**	–
	50	20	31 900	54 000	7 200	6 700	9 500	53	**K 42×50×20**	–
43	48	17	20 900	43 000	5 200	6 700	9 500	30	**K 43×48×17**	–
	48	27	31 900	76 500	9 300	6 700	9 500	50	**K 43×48×27**	–
45	50	17	21 600	46 500	5 600	6 300	9 000	34	**K 45×50×17**	–
	50	27	33 000	81 500	10 000	6 300	9 000	51	**K 45×50×27**	–
	52	18	30 300	57 000	6 950	6 300	9 000	42	**K 45×52×18**	G/SD 45×52×4
	52	21	28 600	53 000	6 400	6 300	9 000	34	**K 45×52×21 TN**	G/SD 45×52×4
	53	20	37 400	68 000	8 300	6 300	9 000	55	**K 45×53×20**	–
	53	21	36 900	67 000	8 300	6 300	9 000	60	**K 45×53×21**	–
	53	28	49 500	98 000	12 200	6 300	9 000	81	**K 45×53×28**	–
	59	18	44 000	53 000	6 550	6 000	8 500	72	**K 45×59×18 TN**	–
47	52	17	22 400	49 000	6 000	6 300	9 000	35	**K 47×52×17**	–
	52	27	33 600	83 000	10 200	6 300	9 000	51	**K 47×52×27**	–
	53	25	36 900	81 500	10 200	6 000	8 500	51	**K 47×53×25**	–

[1] Details of appropriate seals will be found in the section “Seals” (→ **page 214**)

Dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Lubrication grease	oil	Mass	Designation	Appropriate seal[1] Designation
F_w	E_w	U	C	C_0	P_u					
mm			N		N	r/min		g	–	–
50	55	13,5	17 600	36 500	4 300	6 000	8 500	30	**K 50×55×13.5**	–
	55	17	21 200	47 500	5 700	6 000	8 500	35	**K 50×55×17**	–
	55	20	25 500	60 000	7 200	6 000	8 500	43	**K 50×55×20**	–
	55	30	37 400	98 000	12 000	6 000	8 500	65	**K 50×55×30**	–
	57	18	31 900	64 000	7 800	5 600	8 000	47	**K 50×57×18**	–
	58	20	34 100	62 000	7 650	5 600	8 000	75	**K 50×58×20**	G/SD 50×58×4
	58	25	41 800	81 500	10 200	5 600	8 000	90	**K 50×58×25**	G/SD 50×58×4
52	57	12	17 200	36 500	4 300	5 600	8 000	24	**K 52×57×12**	–
55	60	20	27 000	67 000	8 150	5 300	7 500	40	**K 55×60×20**	–
	60	27	35 800	96 500	12 000	5 300	7 500	60	**K 55×60×27**	–
	60	30	39 600	108 000	13 400	5 300	7 500	71	**K 55×60×30**	–
	62	18	34 100	71 000	8 500	5 300	7 500	52	**K 55×62×18**	–
	63	15	25 500	40 500	4 900	5 300	7 500	53	**K 55×63×15**	–
	63	20	38 000	75 000	9 150	5 300	7 500	67	**K 55×63×20**	–
	63	25	48 400	102 000	12 700	5 300	7 500	80	**K 55×63×25**	–
	63	32	59 400	129 000	16 300	5 300	7 500	100	**K 55×63×32**	–
58	65	18	33 600	71 000	8 650	5 000	7 000	52	**K 58×65×18**	–
	65	36	47 300	108 000	12 900	5 000	7 000	125	**K 58×65×36 ZW**	–
60	65	20	28 100	72 000	8 800	5 000	7 000	52	**K 60×65×20**	–
	65	30	41 300	116 000	14 300	5 000	7 000	77	**K 60×65×30**	–
	66	33	44 000	112 000	13 700	5 000	7 000	105	**K 60×66×33 ZW**	–
	66	40	55 000	150 000	18 600	5 000	7 000	115	**K 60×66×40 ZW**	–
	68	20	41 800	86 500	10 600	4 800	6 700	71	**K 60×68×20**	–
	68	23	47 300	102 000	12 500	4 800	6 700	94	**K 60×68×23**	–
	68	25	51 200	112 000	14 000	4 800	6 700	89	**K 60×68×25**	–
	68	30	42 900	88 000	10 600	4 800	6 700	130	**K 60×68×30 ZW**	–
	75	42	112 000	196 000	25 000	4 500	6 300	240	**K 60×75×42**	–
62	70	40	62 700	146 000	18 600	4 800	6 700	175	**K 62×70×40 ZW**	–
64	70	16	26 400	60 000	7 350	4 500	6 300	53	**K 64×70×16**	–
65	70	20	29 200	76 500	9 300	4 500	6 300	56	**K 65×70×20**	–
	70	30	41 800	125 000	15 300	4 500	6 300	83	**K 65×70×30**	–
	73	23	41 800	90 000	11 800	4 500	6 300	110	**K 65×73×23**	–
	73	30	53 900	125 000	15 600	4 500	6 300	140	**K 65×73×30**	–

[1] Details of appropriate seals will be found in the section "Seals" (→ **page 214**)

Needle roller and cage assemblies
F_w **68 – 265** mm



Dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Lubrication grease	oil	Mass	Designation	Appropriate seal[1] Designation
F_w	E_w	U	C	C_0	P_u					
mm			N		N	r/min		g	–	–
68	74	20	33 600	83 000	10 400	4 300	6 000	71	**K 68×74×20**	–
	74	30	44 600	118 000	15 000	4 300	6 000	100	**K 68×74×30**	–
70	76	20	34 100	86 500	10 600	4 300	6 000	71	**K 70×76×20**	–
	76	30	50 100	140 000	17 600	4 300	6 000	110	**K 70×76×30**	–
	78	25	49 500	112 000	14 000	4 300	6 000	120	**K 70×78×25**	G 70×78×5
	78	30	57 200	137 000	17 000	4 300	6 000	150	**K 70×78×30**	G 70×78×5
72	80	20	39 600	85 000	10 600	4 000	5 600	98	**K 72×80×20**	–
73	79	20	35 200	90 000	11 200	4 000	5 600	75	**K 73×79×20**	–
75	81	20	35 800	93 000	11 600	4 000	5 600	79	**K 75×81×20**	–
	81	30	50 100	143000	18 000	4 000	5 600	115	**K 75×81×30**	–
	83	23	47 300	110000	13 700	3 800	5 300	125	**K 75×83×23**	–
	83	30	59 400	143 000	18 000	3 800	5 300	145	**K 75×83×30**	–
80	86	20	36 900	98 000	12 200	3 800	5 300	60	**K 80×86×20**	–
	86	30	53 900	160 000	20 000	3 800	5 300	79	**K 80×86×30**	–
	88	30	68 200	176 000	22 000	3 600	5 000	140	**K 80×88×30**	–
85	92	20	42 900	108 000	13 200	3 400	4 800	100	**K 85×92×20**	–
90	97	20	42 900	114 000	13 700	3 200	4 500	110	**K 90×97×20**	–
	98	27	58 300	150 000	18 600	3 200	4 500	150	**K 90×98×27**	–
	98	30	64 400	173 000	21 600	3 200	4 500	170	**K 90×98×30**	–
95	103	30	66 000	180 000	22 800	3 000	4 300	165	**K 95×103×30**	–
100	107	21	45 700	127 000	15 300	2 800	4 000	120	**K 100×107×21**	–
	108	27	55 000	143 000	17 600	2 800	4 000	185	**K 100×108×27**	–
	108	30	67 100	190 000	23 600	2 800	4 000	180	**K 100×108×30**	–
105	112	21	45 700	129 000	15 300	2 800	4 000	130	**K 105×112×21**	–
110	117	24	53 900	160 000	18 600	2 600	3 800	170	**K 110×117×24**	**–**
	118	30	73 700	220 000	26 500	2 600	3 800	215	**K 110×118×30**	**–**
115	123	27	60 500	170 000	20 000	2 400	3 600	200	**K 115×123×27**	**–**

[1] Details of appropriate seals will be found in the section “Seals” (→ **page 214**)

Dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Lubrication grease	oil	Mass	Designation
F_w	E_w	U	C	C_0	P_u				
mm			N		N	r/min		g	–
120	127	24	56 100	176 000	20 400	2 200	3 400	165	**K 120×127×24**
125	133	35	82 500	260 000	30 500	2 000	3 200	275	**K 125×133×35**
130	137	24	58 300	186 000	21 200	2 000	3 200	170	**K 130×137×24**
135	143	35	88 000	290 000	33 500	1 900	3 000	300	**K 135×143×35**
145	153	26	70 400	224 000	25 000	1 800	2 800	260	**K 145×153×26**
	153	36	93 500	325 000	36 500	1 800	2 800	300	**K 145×153×36**
150	160	46	140 000	475 000	53 000	1 800	2 800	570	**K 150×160×46**
155	163	26	72 100	236 000	25 500	1 700	2 600	265	**K 155×163×26**
	163	36	95 200	340 000	37 500	1 700	2 600	360	**K 155×163×36**
160	170	46	145 000	510 000	56 000	1 700	2 600	550	**K 160×170×46**
165	173	26	76 500	265 000	28 500	1 600	2 400	320	**K 165×173×26**
175	183	32	95 200	355 000	37 500	1 600	2 400	400	**K 175×183×32**
185	195	37	123 000	425 000	45 000	1 500	2 200	605	**K 185×195×37**
195	205	37	125 000	450 000	46 500	1 400	2 000	620	**K 195×205×37**
210	220	42	147 000	560 000	57 000	1 300	1 900	740	**K 210×220×42**
220	230	42	151 000	585 000	58 500	1 200	1 800	790	**K 220×230×42**
240	250	42	157 000	630 000	62 000	1 100	1 700	850	**K 240×250×42**
265	280	50	242 000	850 000	83 000	950	1 500	1 800	**K 265×280×50**


SKF

Drawn cup needle roller bearings

Product tables ..... **page 56**

SKF drawn cup needle roller bearings, as the name suggests, are needle roller bearings with a deep drawn thin-walled outer ring with open or closed end. They are characterised by very low sectional height and high load carrying capacity. They are used when the housing bore cannot be used as a raceway for a needle roller and cage assembly but where a very compact and economic bearing arrangement is required. They are pressed into the housing bore and, if shoulders or retaining rings are not required for axial location, the design of the housing bore is simple and can be economically produced.

Drawn cup needle roller bearings are available with open ends (➔ **fig** 1) or with closed end (➔ **fig** 2). The latter are suitable for bearing arrangements at the ends of shafts. The profiled design of the closed end also permits small axial guidance forces to be accommodated.

Fig 1

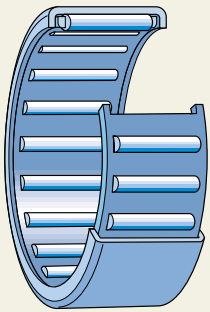
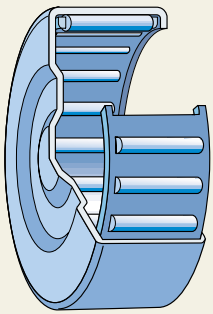


Fig 2



Drawn cup needle roller bearings are generally used directly on the shaft. However, in cases where the shaft cannot be hardened and ground, they can be combined with an inner ring (➔ **fig** 3).

The drawn cup of hardened sheet steel and the needle roller and cage assembly of these bearings form a non-separable unit. The outside surface of the rollers is slightly relieved towards the roller ends; this gives a favourable load distribution in the bearing. The space available for lubricant is large enough to allow long relubrication intervals to be applied.

Normally, drawn cup needle roller bearings have a single row of rollers. However, the relatively wide sizes incorporate two needle roller and cage assemblies immediately adjacent to each other and have a lubrication hole in the outer ring (➔ **fig** 4). 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** 5).

Fig 3

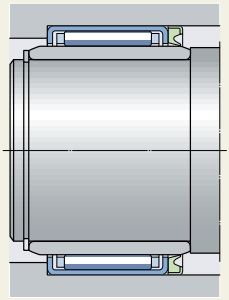


Fig 4

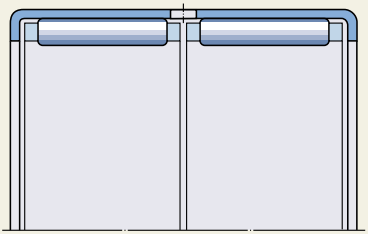
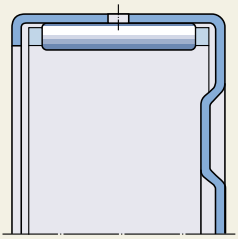


Fig 5



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 seals as follows:

- drawn cup needle roller bearing with open ends, sealed at one side (➔ **fig** 6);
- drawn cup needle roller bearing with open ends, sealed at both sides (➔ **fig** 7);
- sealed drawn cup needle roller bearing with closed end (➔ **fig** 8).

The integral seals are rubbing seals of polyurethane or nitrile rubber (NBR) which, under normal conditions, effectively exclude solid contaminants and moisture and retain the lubricant in the bearing.

Sealed drawn cup needle roller bearings are supplied as standard filled with a high quality lithium base grease of consistency 2 to the NLGI Scale. The grease has good rust inhibiting properties and can be used at temperatures between –30 and +100 °C. The relatively large quantity of grease in the bearings means that they can be operated for long periods before relubrication is required.

Fig 6

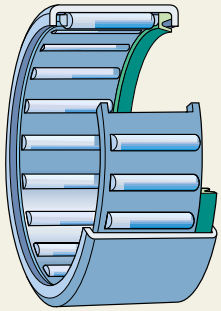


Fig 7

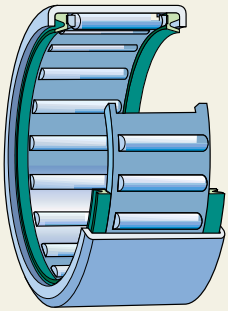
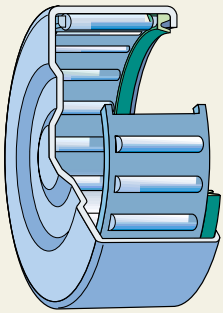


Fig 8



Universal joint bearings

For the universal joints of commercial vehicle propeller shafts, SKF has developed a drawn cup needle roller bearing with closed end (→ **fig** 9). The bearing has high dynamic load carrying capacity and other design refinements. Several sizes are available in the inside diameter range 20 to 48 mm.

The thin-walled, case hardened drawn cup allows the use of relatively large diameter rollers giving high load carrying capacity while still permitting compact bearing arrangements. Other advantages include high axial load carrying capacity without risk of rupture of the base of the drawn cup and good damping of axial shocks by the integral thrust washer of glass fibre reinforced plastic.

The cup spring between the roller ends and seal reduces the risk of false brinelling as it aligns the rollers in the unloaded zone and causes the roller complement to continue rotating.

The integral seals of nitrile rubber (NBR) efficiently prevent dirt and water from penetrating the bearing and retain the lubricating grease in the bearing, thus rendering the bearing maintenance-free.

Further information will be supplied on request.

Dimensions

The boundary dimensions of the drawn cup needle roller bearings are in accordance with ISO 3245:1997.

Tolerances

The dimensional accuracy of drawn cup needle roller bearings cannot be checked until they have been mounted as the thin-walled outer ring may be slightly out-of-round. Only after the bearing has been pressed into a housing bore having the recommended tolerance will the outer ring obtain its correct form, which is decisive for bearing performance. If it is desired to check the inside diameter F_w of the roller set, the bearing must first be pressed into a thick-walled ring having a bore diameter as shown in **Table** 1. A measuring mandrel can then be used to check the inside diameter deviation. The permissible deviations are also given in **Table** 1.

Fig 9

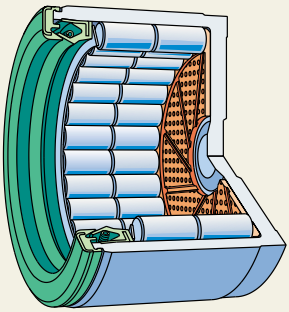


Table 1

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
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 a uniform 0/–0,3 mm for all sizes of drawn cup needle roller bearings.

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 carry the load equally.

Misalignment
The modified line contact between the raceways and the needle rollers not only prevents damaging edge stresses but also enables single row drawn cup needle roller bearings to accept minimum misalignments between shaft and housing.

Cages
SKF drawn cup needle roller bearings incorporate a sheet steel cage (→ **fig** 10) as standard except for those identified by the designation suffix TN. These have an injection moulded glass fibre reinforced polyamide 6,6 cage (→ **fig** 11).

NB.
Drawn cup needle roller bearings with polyamide 6,6 cages can be used at temperatures up to +120 °C. With the exception of a few synthetic oils and greases with a synthetic base oil, and lubricants containing a high proportion of EP additives when used at high temperatures, the lubricants generally used for rolling bearings do not have a detrimental effect on cage properties.

For further information regarding the temperature resistance and use of cages, please refer to the section “Cages” (→ **page 22**).

For bearing arrangements which are to be operated at continuously high temperatures or under arduous conditions, it is recommended that bearings incorporating sheet steel cages be used.

Fig 10

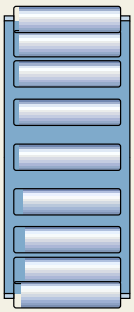


Fig 11



Shaft and housing tolerances

It is particularly important for drawn cup needle roller bearings that the housing bore has good accuracy of dimensions and form. If the values given in **Table** 2 are adhered to then the bearings will obtain the necessary interference fit in the housing. The inside diameter (diameter under the rollers) will then be approximately within tolerance F8. This, together with the recommended shaft tolerance which is also given in **Table** 2, will result in a normal radial internal clearance in the bearing arrangement. The cylindricity of the housing bore should be within IT5/2.

Raceways on the shaft

If the full load carrying capacity of drawn cup needle roller bearings is to be exploited, the raceways on the shaft must have the hardness and surface finish normally found on bearing raceways. Recommendations will be found in the section "Raceways on shafts and in housings" (➔ **page 28**).

Mounting instructions

The best way to mount drawn cup needle roller bearings is to use a mounting dolly (➔ **fig** 12). The bearing can be held in position by an O-ring. The stamped side face of drawn cup needle roller bearings should preferably abut the flange of the mounting dolly.

Special care should be taken to see that the bearings do not skew or tilt when they are being pressed into the housing.

Table 2

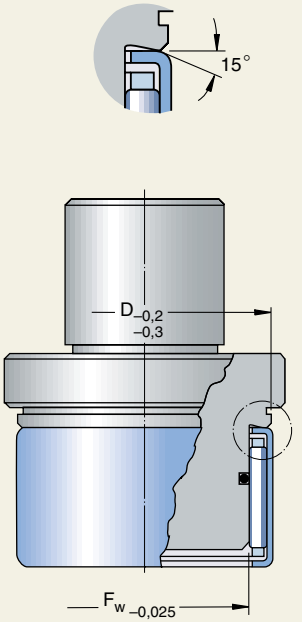
Shaft and housing tolerances

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

[1] For housings which 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 1101-1985 for the housing bore must correspond to tolerance IT5/2

Fig 12



Minimum load
In order to guarantee satisfactory operation, drawn cup needle roller bearings, like all ball and roller bearings, must always be subjected to a given minimum load, particularly if they are to operate at high speeds or are subjected to high accelerations or rapid changes in the direction of load. Under such conditions the inertia forces of the needle rollers and cage of drawn cup needle roller bearings, and the friction in the lubricant, can have a detrimental influence on the rolling conditions in the bearing arrangement and may cause damaging sliding movements to occur between the rollers and raceways.

The requisite minimum radial load to be applied to drawn cup needle roller bearings can be estimated using

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

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

When starting up at low temperatures or when the lubricant is highly viscous, even greater loads may be required. The weights of the components supported by the bearing, together with the external forces, generally exceed the requisite minimum load. If this is not the case, the drawn cup needle roller bearing must be subjected to an additional radial load.

Equivalent dynamic bearing load
Drawn cup needle roller bearings can only take radial loads, therefore

$$P = F_r$$

Equivalent static bearing load
Drawn cup needle roller bearings can only take radial loads, therefore

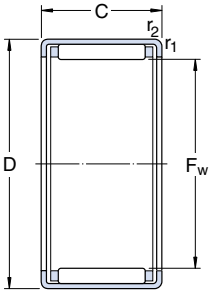
$$P_0 = F_r$$

Static load carrying capacity
It should be observed that a static safety factor of 3 or larger should be applied, i.e.
$s_0 = C_0/P_0 \geq 3$.

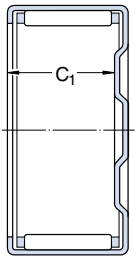
Supplementary designations
The designation suffixes used to identify certain features of SKF drawn cup needle roller bearings are explained in the following.

AS1	One lubrication hole in the outer ring
RS	Seal at one side of the bearing
2RS	Seal at both sides of drawn cup needle roller bearing with open ends
SM03	Lithium base grease of consistency 2 for operating temperatures of –25 to +150 °C
TN	Injection moulded cage of glass fibre reinforced polyamide 6,6

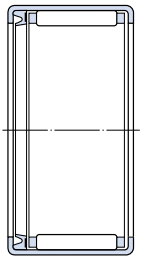
Drawn cup needle roller bearings
F_w **3 – 10** mm



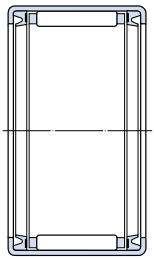
With open ends
Series HK



With closed end
Series BK

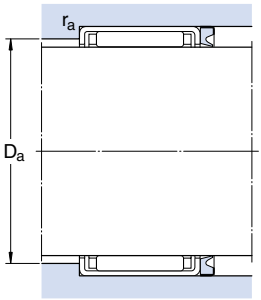


With open ends
and one seal
Series HK .. RS



With open ends
and two seals
Series HK .. 2RS

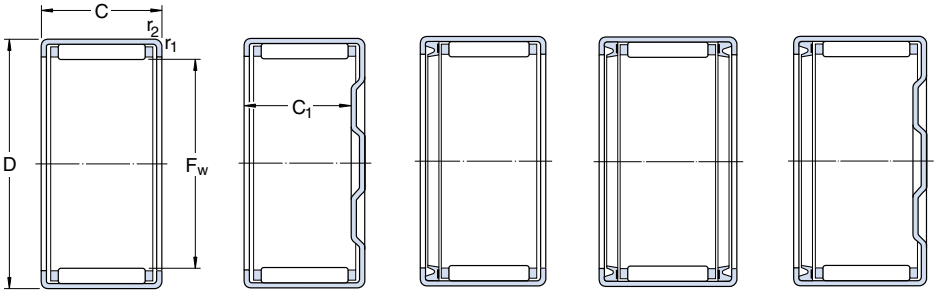
Principal dimensions			**Basic load ratings** dynamic	static	**Fatigue load limit**	**Speed ratings** Lubrication grease	oil	**Mass**	**Designation**
F_w	D	C	C	C_0	P_u				
mm			N		N	r/min		g	–
3	6,5	6	1 230	880	88	30 000	43 000	1,0	**HK 0306 TN**
	6,5	6	1 230	880	88	30 000	43 000	1,0	**BK 0306 TN**
4	8	8	1 760	1 370	140	26 000	38 000	2,0	**HK 0408**
	8	8	1 760	1 370	140	26 000	38 000	2,1	**BK 0408**
5	9	9	2 380	2 080	220	22 000	34 000	2,0	**HK 0509**
	9	9	2 380	2 080	220	22 000	34 000	2,1	**BK 0509**
6	10	8	2 010	1 730	180	20 000	32 000	2,1	**HK 0608**
	10	9	2 810	2 700	285	20 000	32 000	2,5	**HK 0609**
	10	9	2 810	2 700	285	20 000	32 000	2,6	**BK 0609**
7	11	9	3 030	3 050	325	18 000	28 000	2,6	**HK 0709**
	11	9	3 030	3 050	325	18 000	28 000	2,9	**BK 0709**
8	12	8	2 700	2 750	285	17 000	26 000	2,7	**HK 0808**
	12	8	2 700	2 750	285	17 000	26 000	3,0	**BK 0808**
	12	10	3 690	4 050	440	17 000	26 000	3,0	**HK 0810**
	12	10	2 700	2 750	285	14 000	–	3,0	**HK 0810 RS**
	12	10	3 690	4 050	440	17 000	26 000	3,4	**BK 0810**
	12	12	2 700	2 750	285	14 000	–	3,3	**HK 0812.2RS**
9	13	8	3 520	3 900	415	16 000	24 000	3,0	**HK 0908**
	13	10	4 130	4 800	530	16 000	24 000	4,0	**HK 0910**
	13	10	4 130	4 800	530	16 000	24 000	4,3	**BK 0910**
	13	12	5 120	6 400	720	16 000	24 000	4,6	**HK 0912**
	13	12	5 120	6 400	720	16 000	24 000	4,9	**BK 0912**
10	14	10	4 290	5 300	570	16 000	24 000	4,1	**HK 1010**
	14	10	4 290	5 300	570	16 000	24 000	4,3	**BK 1010**
	14	12	5 390	6 950	780	16 000	24 000	4,8	**HK 1012**
	14	12	4 290	5 300	570	13 000	–	4,2	**HK 1012 RS**
	14	12	5 390	6 950	780	16 000	24 000	5,0	**BK 1012**
	14	14	4 290	5 300	570	13 000	–	4,6	**HK 1014.2RS**
	14	15	6 600	9 000	1 020	16 000	24 000	6,0	**HK 1015**
	14	15	6 600	9 000	1 020	16 000	24 000	6,2	**BK 1015**



Dimensions			Abutment and fillet dimensions		Appropriate inner ring[1] Designation	seal[1] Designation
F_w	C_1	$r_{1,2}$ min	D_a max	r_a max		
mm			mm		–	
3	–	0,3	3,5	0,3	–	–
	5,2	0,3	3,5	0,3	–	–
4	–	0,3	5	0,3	–	G 4×8×2 S
	6,4	0,3	5	0,3	–	G 4×8×2 S
5	–	0,4	5,3	0,4	–	G 5×9×2 S
	7,2	0,4	5,3	0,4	–	G 5×9×2 S
6	–	0,4	6,3	0,4	–	G 6×10×2 S
	–	0,4	6,3	0,4	–	G 6×10×2 S
	7,4	0,4	6,3	0,4	–	G 6×10×2 S
7	–	0,4	7,3	0,4	–	G 7×11×2 S
	7,4	0,4	7,3	0,4	–	G 7×11×2 S
8	–	0,4	8,3	0,4	–	G 8×12×3
	6,4	0,4	8,3	0,4	–	G 8×12×3
	–	0,4	8,3	0,4	IR 5×8×12	G 8×12×3
	–	0,4	8,3	0,4	IR 5×8×12	–
	8,4	0,4	8,3	0,4	IR 5×8×12	G 8×12×3
	–	0,4	8,3	0,4	IR 5×8×16	–
9	–	0,4	9,3	0,4	–	G 9×13×3
	–	0,4	9,3	0,4	IR 6×9×12	G 9×13×3
	8,2	0,4	9,3	0,4	IR 6×9×12	G 9×13×3
	–	0,4	9,3	0,4	IR 6×9×12	G 9×13×3
	10,4	0,4	9,3	0,4	IR 6×9×12	G 9×13×3
10	–	0,4	10,3	0,4	IR 7×10×10.5	G 10×14×3
	8,4	0,4	10,3	0,4	IR 7×10×10.5	G 10×14×3
	–	0,4	10,3	0,4	IR 7×10×12	G 10×14×3
	–	0,4	10,3	0,4	–	–
	10,4	0,4	10,3	0,4	IR 7×10×12	G 10×14×3
	–	0,4	10,3	0,4	IR 7×10×16	–
	–	0,4	10,3	0,4	IR 7×10×16	G 10×14×3
	13,4	0,4	10,3	0,4	IR 7×10×16	G 10×14×3

[1] Details of appropriate inner rings and seals will be found in the sections “Inner rings” (**➔ page 204**) and “Seals” (**➔ page 214**)

Drawn cup needle roller bearings
F_w **12 – 17** mm



With open ends
Series HK

With closed end
Series BK

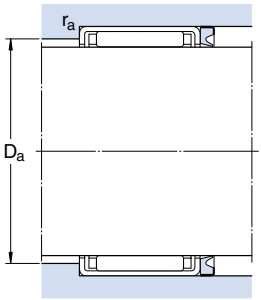
With open ends
and one seal
Series HK .. RS

With open ends
and two seals
Series HK .. 2RS

With closed end
and one seal
Series BK .. RS

Principal dimensions			**Basic load ratings** dynamic	static	**Fatigue load limit**	**Speed ratings** Lubrication grease	oil	**Mass**	**Designation**
F_w	D	C	C	C_0	P_u				
mm			N		N	r/min		g	–
12	16	10	4 840	6 400	710	14 000	20 000	4,6	**HK 1210**
	16	10	4 840	6 400	710	14 000	20 000	5,2	**BK 1210**
	18	12	6 270	7 350	850	14 000	20 000	9,0	**HK 1212**
	18	12	6 270	7 350	850	14 000	20 000	10	**BK 1212**
	18	14	6 270	7 350	850	12 000	–	10	**HK 1214 RS**
	18	16	6 270	7 350	850	12 000	–	11	**HK 1216.2RS**
13	19	12	6 600	8 000	915	13 000	19 000	10	**HK 1312**
	19	12	6 600	8 000	915	13 000	19 000	11	**BK 1312**
14	20	12	6 820	8 650	980	12 000	18 000	11	**HK 1412**
	20	12	6 820	8 650	980	12 000	18 000	12	**BK 1412**
	20	14	6 820	8 650	980	11 000	–	12	**HK 1414 RS**
	20	14	6 820	8 650	980	11 000	–	13	**BK 1414 RS**
	20	16	6 820	8 650	980	11 000	–	13	**HK 1416.2RS**
15	21	12	7 650	9 500	1 080	11 000	17 000	11	**HK 1512**
	21	12	7 650	9 500	1 080	11 000	17 000	13	**BK 1512**
	21	14	7 480	10 000	1 140	11 000	–	12	**HK 1514 RS**
	21	16	10 100	14 600	1 700	11 000	17 000	15	**HK 1516**
	21	16	7 480	10 000	1 140	11 000	–	15	**HK 1516.2RS**
	21	16	10 100	14 600	1 700	11 000	17 000	17	**BK 1516**
	21	18	10 100	14 600	1 700	11 000	–	16	**HK 1518 RS**
	21	20	10 100	14 600	1 700	11 000	–	18	**HK 1520.2RS**
	21	22	13 000	20 000	2 280	11 000	17 000	20	**HK 1522**[1]
16	22	12	7 370	9 800	1 120	10 000	16 000	12	**HK 1612**
	22	12	7 370	9 800	1 120	10 000	16 000	14	**BK 1612**
	22	14	7 370	9 800	1 120	10 000	–	13	**HK 1614 RS**
	22	14	7 370	9 800	1 120	10 000	–	15	**BK 1614 RS**
	22	16	10 500	15 600	1 800	10 000	16 000	16	**HK 1616**
	22	16	7 370	9 800	1 120	10 000	–	14	**HK 1616.2RS**
	22	16	10 500	15 600	1 800	10 000	16 000	18	**BK 1616**
	22	20	11 000	14 600	1 660	10 000	–	18	**HK 1620.2RS**
	22	22	12 800	19 600	2 240	10 000	16 000	22	**HK 1622**[1]
	22	22	12 800	19 600	2 240	10 000	16 000	24	**BK 1622**[1]
17	23	12	7 650	10 600	1 200	10 000	16 000	12	**HK 1712**

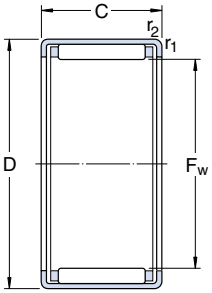
[1] Double row



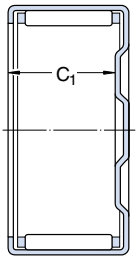
Dimensions			Abutment and fillet dimensions		Appropriate inner ring[1] Designation	seal[1] Designation
F_w	C_1	$r_{1,2}$ min	D_a max	r_a max		
mm			mm		–	
12	–	0,4	12,3	0,4	IR 8×12×10.5	G 12×16×3
	8,4	0,4	12,3	0,4	IR 8×12×10.5	G 12×16×3
	–	0,8	13	0,8	IR 8×12×12.5	G/SD 12×18×3
	9,3	0,8	13	0,8	IR 8×12×12.5	G/SD 12×18×3
	–	0,8	13	0,8	LR/IR 8×12×12.5	–
	–	0,8	13	0,8	–	–
13	–	0,8	14	0,8	IR 10×13×12.5	G/SD 13×19×3
	9,3	0,8	14	0,8	IR 10×13×12.5	G/SD 13×19×3
14	–	0,8	15	0,8	IR 10×14×13	G/SD 14×20×3
	9,3	0,8	15	0,8	IR 10×14×13	G/SD 14×20×3
	–	0,8	15	0,8	IR 10×14×16	–
	11,3	0,8	15	0,8	IR 10×14×13	–
	–	0,8	15	0,8	IR 10×14×20	–
15	–	0,8	16	0,8	IR 12×15×12.5	G/SD 15×21×3
	9,3	0,8	16	0,8	IR 12×15×12.5	G/SD 15×21×3
	–	0,8	16	0,8	LR 12×15×16.5	–
	–	0,8	16	0,8	IR 12×15×16.5	G/SD 15×21×3
	–	0,8	16	0,8	LR/IR 12×15×16.5	–
	13,3	0,8	16	0,8	IR 12×15×16.5	G/SD 15×21×3
	–	0,8	16	0,8	–	–
	–	0,8	16	0,8	LR/IR 12×15×22.5	–
	–	0,8	16	0,8	IR 12×15 ×22.5	G/SD 15×21×3
16	–	0,8	17	0,8	IR 12×16×13	G/SD 16×22×3
	9,3	0,8	17	0,8	IR 12×16×13	G/SD 16×22×3
	–	0,8	17	0,8	IR 12×16×16	–
	11,3	0,8	17	0,8	IR 12×16×13	–
	–	0,8	17	0,8	IR 12×16×16	G/SD 16×22×3
	–	0,8	17	0,8	IR 12×16×20	–
	13,3	0,8	17	0,8	IR 12×16×16	G/SD 16×22×3
	–	0,8	17	0,8	IR 12×16×22	–
	–	0,8	17	0,8	IR 12×16×22	G/SD 16×22×3
	19,3	0,8	17	0,8	IR 12×16×22	G/SD 16×22×3
17	–	0,8	18	0,8	–	G/SD 17×23×3

[1] Details of appropriate inner rings and seals will be found in the sections “Inner rings” (**➔ page 204**) and “Seals” (**➔ page 214**)

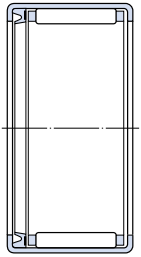
Drawn cup needle roller bearings
F_w **18 – 25** mm



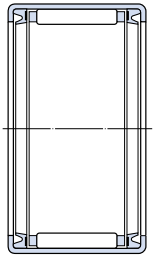
With open ends
Series HK



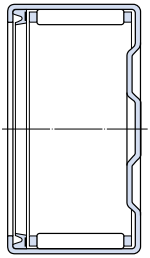
With closed end
Series BK



With open ends
and one seal
Series HK .. RS



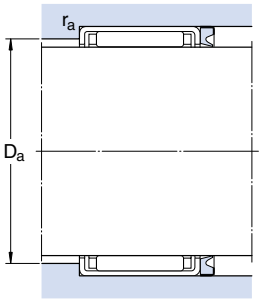
With open ends
and two seals
Series HK .. 2RS



With closed end
and one seal
Series BK .. RS

Principal dimensions			**Basic load ratings** dynamic	static	**Fatigue load limit**	**Speed ratings** Lubrication grease	oil	**Mass**	**Designation**
F_w	D	C	C	C_0	P_u				
mm			N		N	r/min		g	–
18	24	12	7 920	11 200	1 270	9 500	15 000	13	**HK 1812**
	24	12	7 920	11 200	1 270	9 500	15 000	15	**BK 1812**
	24	14	7 920	11 200	1 270	9 500	–	14	**HK 1814 RS**
	24	16	11 200	17 600	2 040	9 500	15 000	18	**HK 1816**
	24	16	7 920	11 200	1 270	9 500	–	15	**HK 1816.2RS**
	24	16	11 200	17 600	2 040	9 500	15 000	20	**BK 1816**
20	26	10	6 160	8 500	930	9 000	14 000	12	**HK 2010**
	26	12	8 420	12 500	1 400	9 000	14 000	14	**HK 2012**
	26	16	12 300	20 400	2 360	9 000	14 000	19	**HK 2016**
	26	16	8 420	12 500	1 400	9 000	–	18	**HK 2016.2RS**
	26	16	12 300	20 400	2 360	9 000	14 000	22	**BK 2016**
	26	18	12 300	20 400	2 360	9 000	–	21	**HK 2018 RS**
	26	18	12 300	20 400	2 360	9 000	–	24	**BK 2018 RS**
	26	20	15 100	26 500	3 150	9 000	14 000	24	**HK 2020**
	26	20	12 300	20 400	2 360	9 000	–	23	**HK 2020.2RS**
	26	20	15 100	26 500	3 150	9 000	14 000	27	**BK 2020** [1]
	26	30	20 900	40 500	4 750	9 000	14 000	35	**HK 2030** [1]
22	28	10	7 210	10 600	1 200	8 000	12 000	13	**HK 2210**
	28	12	8 800	13 700	1 560	8 000	12 000	15	**HK 2212**
	28	12	8 800	13 700	1 560	8 000	12 000	18	**BK 2212**
	28	14	8 800	13 700	1 560	8 000	–	16	**HK 2214 RS**
	28	16	13 000	22 400	2 600	8 000	12 000	21	**HK 2216**
	28	16	8 800	13 700	1 560	8 000	–	18	**HK 2216.2RS**
	28	16	13 000	22 400	2 600	8 000	12 000	24	**BK 2216**
	28	18	13 000	22 400	2 600	8 000	–	24	**HK 2218 RS**
	28	20	15 700	29 000	3 450	8 000	12 000	26	**HK 2220**
	28	20	13 000	22 400	2 600	8 000	–	26	**HK 2220.2RS**
25	32	12	10 500	15 300	1 760	7 500	11 000	20	**HK 2512**
	32	16	15 100	24 000	2 850	7 500	11 000	27	**HK 2516**
	32	16	10 500	15 300	1 760	7 000	–	27	**HK 2516.2RS**
	32	18	15 100	24 000	2 850	7 000	–	29	**HK 2518 RS**
	32	18	15 100	24 000	2 850	7 000	–	34	**BK 2518 RS**
	32	20	19 000	32 500	4 000	7 500	11 000	33	**HK 2520**
	32	20	15 100	24 000	2 850	7 000	–	31	**HK 2520.2RS**
	32	20	19 000	32 500	4 000	7 500	11 000	38	**BK 2520**
	32	24	19 000	32 500	4 000	7 000	–	40	**HK 2524.2RS**
	32	26	24 200	45 000	5 500	7 500	11 000	44	**HK 2526**

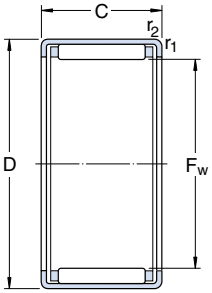
[1] Double row



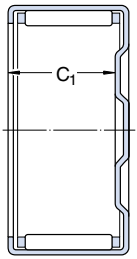
Dimensions			Abutment and fillet dimensions		Appropriate inner ring[1] Designation	seal[1] Designation
F_w	C_1	$r_{1,2}$ min	D_a max	r_a max		
mm			mm		–	
18	–	0,8	19	0,8	IR 15×18×16.5	G/SD 18×24×3
	9,3	0,8	19	0,8	IR 15×18×16.5	G/SD 18×24×3
	–	0,8	19	0,8	LR/IR 15×18×16.5	–
	–	0,8	19	0,8	IR 15×18×16.5	G/SD 18×24×3
	–	0,8	19	0,8	LR/IR 15×18×16.5	–
	13,3	0,8	19	0,8	IR 15×18×16.5	G/SD 18×24×3
20	–	0,8	20,8	0,8	IR 15×20×12 IS1	G/SD 20×26×4
	–	0,8	20,8	0,8	IR 15×20×13	G/SD 20×26×4
	–	0,8	20,8	0,8	IR 17×20×16.5	G/SD 20×26×4
	–	0,8	21	0,8	LR/IR 17×20×16.5	–
	13,3	0,8	20,8	0,8	IR 17×20×16.5	G/SD 20×26×4
	–	0,8	21	0,8	LR/IR 17×20×20.5	–
	15,3	0,8	21	0,8	LR 17×20×16.5	–
	–	0,8	20,8	0,8	IR 17×20×20.5	G/SD 20×26×4
	–	0,8	21	0,8	LR/IR 17×20×20.5	–
	17,3	0,8	20,8	0,8	LR 17×20×20.5	G/SD 20×26×4
	–	0,8	20,8	0,8	IR 17×20×30.5	G/SD 26×34×4
22	–	0,8	23	0,8	IR 17×22×13	G/SD 22×28×4
	–	0,8	23	0,8	IR 17×22×13	G/SD 22×28×4
	9,3	0,8	23	0,8	IR 17×22×13	G/SD 22×28×4
	–	0,8	23	0,8	IR 17×22×16	–
	–	0,8	23	0,8	IR 17×22×16	G/SD 22×28×4
	–	0,8	23	0,8	IR 17×22×23	–
	13,3	0,8	23	0,8	IR 17×22×16	G/SD 22×28×4
	–	0,8	23	0,8	IR 17×22×23	–
	–	0,8	23	0,8	IR 17×22×23	G/SD 22×28×4
	–	0,8	23	0,8	IR 17×22×23	–
25	–	0,8	27	0,8	–	G 25×32×4
	–	0,8	27	0,8	IR 20×25×17	G 25×32×4
	–	0,8	27	0,8	LR 20×25×16.5	–
	–	0,8	27	0,8	LR/IR 20×25×20.5	–
	15,3	0,8	27	0,8	LR 20×25×16.5	–
	–	0,8	27	0,8	IR 20×25×20.5	G 25×32×4
	–	0,8	27	0,8	LR/IR 20×25×20.5	–
	17,3	0,8	27	0,8	IR 20×25×20.5	G 25×32×4
	–	0,8	27	0,8	LR 20×25×26.5	–
	–	0,8	27	0,8	IR 20×25×26.5	G 25×32×4

[1] Details of appropriate inner rings and seals will be found in the sections “Inner rings” (➔ **page 204**) and “Seals” (➔ **page 214**)

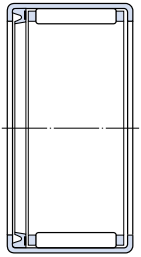
Drawn cup needle roller bearings
F_w **25 – 40** mm



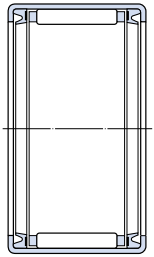
With open ends
Series HK



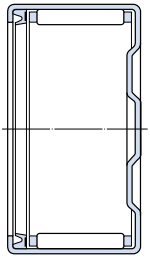
With closed end
Series BK



With open ends
and one seal
Series HK .. RS



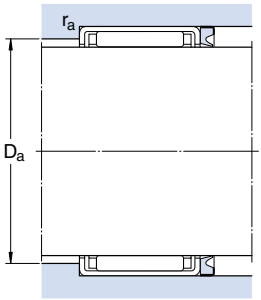
With open ends
and two seals
Series HK .. 2RS



With closed end
and one seal
Series BK .. RS

Principal dimensions			**Basic load ratings** dynamic	static	**Fatigue load limit**	**Speed ratings** Lubrication grease	oil	**Mass**	**Designation**
F_w	D	C	C	C_0	P_u				
mm			N		N	r/min		g	–
25	32	26	24 200	45 000	5 500	7 500	11 000	48	**BK 2526**
(cont.)	32	30	24 200	45 000	5 500	7 000	–	47	**HK 2530.2RS**
	32	38	33 000	65 500	8 000	7 500	11 000	64	**HK 2538**[1]
	32	38	33 000	65 500	8 000	7 500	11 000	68	**BK 2538**[1]
28	35	16	15 700	26 500	3 150	6 700	9 500	29	**HK 2816**
	35	20	20 100	36 500	4 400	6 700	9 500	36	**HK 2820**
	35	20	15 700	26 500	3 150	6 300	–	34	**HK 2820.2RS**
30	37	12	11 700	18 300	2 120	6 300	9 000	23	**HK 3012**
	37	12	11 700	18 300	2 120	6 300	9 000	28	**BK 3012**
	37	16	16 500	29 000	3 400	6 300	9 000	31	**HK 3016**
	37	16	11 700	18 300	2 120	6 000	–	31	**HK 3016.2RS**
	37	16	16 500	29 000	3 400	6 300	9 000	38	**BK 3016**
	37	18	16 500	29 000	3 400	6 000	–	37	**HK 3018 RS**
	37	20	20 900	40 000	4 750	6 300	9 000	39	**HK 3020**
	37	20	16 500	29 000	3 400	6 000	–	36	**HK 3020.2RS**
	37	20	20 900	40 000	4 750	6 300	9 000	47	**BK 3020**
	37	24	20 900	40 000	4 750	6 000	–	44	**HK 3024.2RS**
	37	26	27 000	54 000	6 550	6 300	9 000	51	**HK 3026**
	37	26	27 000	54 000	6 550	6 300	9 000	58	**BK 3026**
	37	38	35 800	80 000	9 500	6 300	9 000	76	**HK 3038**[1]
	37	38	35 800	80 000	9 500	6 300	9 000	84	**BK 3038**[1]
35	42	12	12 500	21 600	2 450	5 600	8 000	27	**HK 3512**
	42	16	17 900	34 000	4 000	5 600	8 000	36	**HK 3516**
	42	16	12 500	21 600	2 450	5 300	–	32	**HK 3516.2RS**
	42	18	17 900	34 000	4 000	5 300	–	39	**HK 3518 RS**
	42	20	22 900	46 500	5 600	5 600	8 000	44	**HK 3520**
	42	20	17 900	34 000	4 000	5 300	–	41	**HK 3520.2RS**
	42	20	22 900	46 500	5 600	5 600	8 000	53	**BK 3520**
40	47	12	13 400	24 500	2 800	5 000	7 000	30	**HK 4012**
	47	16	19 000	39 000	4 550	5 000	7 000	39	**HK 4016**
	47	16	13 400	24 500	2 800	4 500	–	37	**HK 4016.2RS**
	47	18	19 000	39 000	4 550	4 500	–	45	**HK 4018 RS**
	47	20	24 200	53 000	6 400	5 000	7 000	54	**HK 4020**
	47	20	19 000	39 000	4 550	4 500	–	48	**HK 4020.2RS**
	47	20	24 200	53 000	6 400	5 000	7 000	62	**BK 4020**

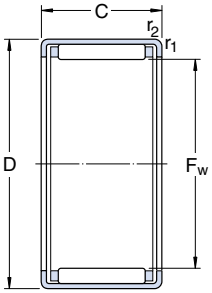
[1] Double row



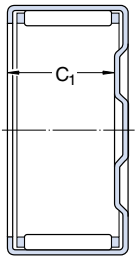
Dimensions			Abutment and fillet dimensions		Appropriate inner ring[1] Designation	seal[1] Designation
F_w	C_1	$r_{1,2}$ min	D_a max	r_a max		
mm			mm		–	
25	23,3	0,8	27	0,8	IR 20×25×26.5	G 25×32×4
(cont.)	–	0,8	27	0,8	IR 20×25×30	–
	–	0,8	27	0,8	IR 20×25×38.5	G 25×32×4
	35,3	0,8	27	0,8	IR 20×25×38.5	G 25×32×4
28	–	0,8	30	0,8	IR 22×28×17	G/SD 28×35×4
	–	0,8	30	0,8	IR 22×28×20.5	G/SD 28×35×4
	–	0,8	30	0,8	LR/IR 22×28×20.5	–
30	–	0,8	32	0,8	–	G/SD 30×37×4
	9,3	0,8	32	0,8	–	G/SD 30×37×4
	–	0,8	32	0,8	IR 25×30×17	G/SD 30×37×4
	–	0,8	32	0,8	LR 25×30×16.5	–
	13,3	0,8	32	0,8	IR 25×30×17	G/SD 30×37×4
	–	0,8	32	0,8	LR/IR 25×30×20.5	–
	–	0,8	32	0,8	IR 25×30×20.5	G/SD 30×37×4
	–	0,8	32	0,8	LR/IR 25×30×20.5	–
	17,3	0,8	32	0,8	IR 25×30×20.5	G/SD 30×37×4
	–	0,8	32	0,8	LR/IR 25×30×26.5	–
	–	0,8	32	0,8	IR 25×30×26.5	G/SD 30×37×4
	23,3	0,8	32	0,8	IR 25×30×26.5	G/SD 30×37×4
	–	0,8	32	0,8	IR 25×30×38.5	G/SD 30×37×4
	35,3	0,8	32	0,8	IR 25×30×38.5	G/SD 30×37×4
35	–	0,8	37	0,8	–	G/SD 35×42×4
	–	0,8	37	0,8	IR 30×35×17	G/SD 35×42×4
	–	0,8	37	0,8	LR 30×35×16.5	–
	–	0,8	37	0,8	LR/IR 30×35×20.5	–
	–	0,8	37	0,8	IR 30×35×20.5	G/SD 35×42×4
	–	0,8	37	0,8	LR/IR 30×35×20.5	–
	17,3	0,8	37	0,8	IR 30×35×20.5	G/SD 35×42×4
40	–	0,8	42	0,8	–	–
	–	0,8	42	0,8	IR 35×40×17	G/SD 40×47×4
	–	0,8	42	0,8	LR 35×40×16.5	–
	–	0,8	42	0,8	LR/IR 35×40×20.5	–
	–	0,8	42	0,8	IR 35×40×20.5	G/SD 40×47×4
	–	0,8	42	0,8	LR/IR 35×40×20.5	–
	17,3	0,8	42	0,8	IR 35×40×20.5	G/SD 40×47×4

[1] Details of appropriate inner rings and seals will be found in the sections “Inner rings” (**➔ page 204**) and “Seals” (**➔ page 214**)

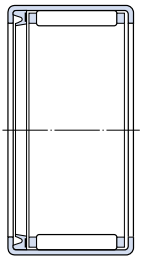
Drawn cup needle roller bearings
F_w **45 – 60** mm



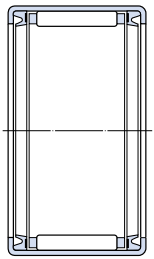
With open ends
Series HK



With closed end
Series BK

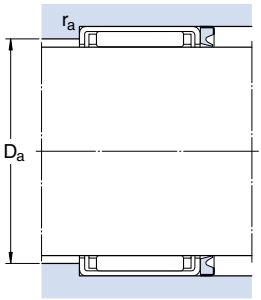


With open ends
and one seal
Series HK .. RS



With open ends
and two seals
Series HK .. 2RS

Principal dimensions			**Basic load ratings** dynamic	static	**Fatigue load limit**	**Speed ratings** Lubrication grease	oil	**Mass**	**Designation**
F_w	D	C	C	C_0	P_u				
mm			N		N	r/min		g	–
45	52	12	14 200	27 500	3 200	4 500	6 300	33	**HK 4512**
	52	16	20 500	43 000	5 100	4 500	6 300	46	**HK 4516**
	52	18	20 500	43 000	5 100	4 300	–	50	**HK 4518 RS**
	52	20	26 000	60 000	7 200	4 500	6 300	56	**HK 4520**
	52	20	20 500	43 000	5 100	4 300	–	54	**HK 4520.2RS**
	52	20	26 000	60 000	7 200	4 500	6 300	72	**BK 4520**
50	58	20	29 200	63 000	7 800	4 000	5 600	70	**HK 5020**
	58	22	29 200	63 000	7 800	3 800	–	76	**HK 5022 RS**
	58	24	29 200	63 000	7 800	3 800	–	81	**HK 5024.2RS**
	58	25	36 900	85 000	10 600	4 000	5 600	90	**HK 5025**
55	63	20	30 300	67 000	8 300	3 600	5 000	74	**HK 5520**
	63	28	41 800	104 000	12 900	3 600	5 000	11	**HK 5528**
60	68	12	17 600	32 000	3 800	3 400	4 800	49	**HK 6012**
	68	20	31 900	75 000	9 300	3 400	4 800	81	**HK 6020**
	68	32	51 200	137 000	17 000	3 400	4 800	140	**HK 6032**



Dimensions			Abutment and fillet dimensions		Appropriate inner ring[1] Designation	seal[1] Designation
F_w	C_1	$r_{1,2}$ min	D_a max	r_a max		
mm			mm		–	
45	–	0,8	47	0,8	–	G/SD 45×52×4
	–	0,8	47	0,8	IR 40×45×17	G/SD 45×52×4
	–	0,8	47	0,8	LR/IR 40×45×20.5	–
	–	0,8	47	0,8	IR 40×45×20.5	G/SD 45×52×4
	–	0,8	47	0,8	LR/IR 40×45×20.5	–
	17,3	0,8	47	0,8	IR 40×45×20.5	G/SD 45×52×4
50	–	0,8	53	0,8	LR 45×50×20.5	G/SD 50×58×4
	–	0,8	53	0,8	LR/IR 45×50×25.5	–
	–	0,8	53	0,8	LR/IR 45×50×25.5	–
	–	0,8	53	0,8	LR 45×50×25.5	G/SD 50×58×4
55	–	0,8	58	0,8	LR 50×55×20.5	–
	–	0,8	58	0,8	–	–
60	–	0,8	63	0,8	–	–
	–	0,8	63	0,8	–	–
	–	0,8	63	0,8	–	–

[1] Details of appropriate inner rings and seals will be found in the sections “Inner rings” (**➔ page 204**) and “Seals” (**➔ page 214**)


SKF

Needle roller bearings

Product tables

Needle roller bearings with flanges, without inner ring ..... **page 74**
Needle roller bearings with flanges, with inner ring ..... **page 88**
Needle roller bearings without flanges, without inner ring ..... **page 100**
Needle roller bearings without flanges, with inner ring ..... **page 104**

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

Needle roller bearings without inner ring (→ **fig** 1) are an excellent choice for bearing arrangements where the shaft can be hardened and ground. As no inner ring is needed, the shaft used will be relatively stronger and stiffer. The 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 appropriate dimensional and form accuracies it is possible to produce bearing arrangements with heightened running accuracy.

Needle roller bearings with inner ring (→ **fig** 2) are used for arrangements where it is not possible, or not economic, to harden and grind the shaft. Bearings with inner ring only permit axial displacement of the shaft relative to the housing within certain limits. If this is insufficient it is possible to use an extended inner ring instead of the standard inner ring. Details will be found in the section "Inner rings" (→ **page 204**).

Fig 1

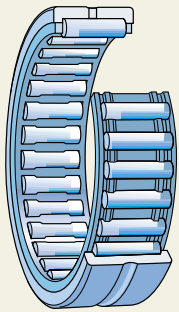
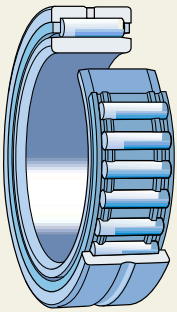


Fig 2



SKF needle roller bearings are produced in several designs and many sizes. The majority of these are bearings with inserted or integral internal outer ring flanges (➔ **fig** 3), some of which are also available in sealed versions (➔ **fig** 5). Also included in the range are bearings without outer ring flanges (➔ **fig** 4).

Fig 3

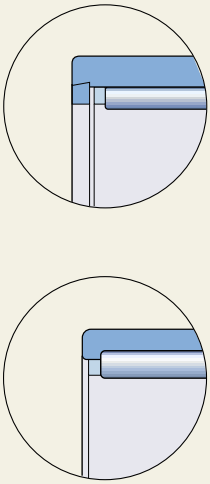


Fig 4

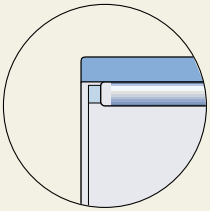
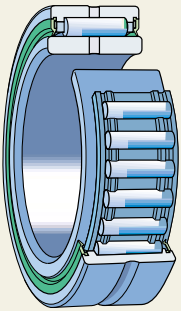


Fig 5



Needle roller bearings with flanges
SKF needle roller bearings with flanges in the outer ring and outside diameters up to and including 17 mm are produced with inserted closure rings, are without lubrication hole and do not have an annular groove (➔ **fig** 6). The larger bearings have integral flanges, an annular groove and, depending on size, one or more lubrication holes in the outer ring (➔ **fig** 7). The needle roller bearings with flanges are generally designed as single row bearings. The exceptions are bearings of series RNA 69 and NA 69 with an outside diameter of 52 mm and above. These have two needle roller and cage assemblies which are guided between integral flanges in the outer ring (➔ **fig** 8). The outer ring with needle roller and cage assembly (assemblies) of all bearings forms a non-separable unit.

Sealed bearings

Single row bearings of series RNA 49 and NA 49 are also available with a rubbing seal at one side (➔ **fig** 9) or at both sides (➔ **fig** 10). The seals are made of nitrile rubber (NBR) and protect the bearings efficiently against the entry of contaminants. All sealed bearings are supplied as standard filled with a high-quality lithium base grease of consistency 2 to the NLGI Scale which has good rust inhibiting properties. The operating temperature range for the grease is from –30 to +120 °C.

The inner rings of the sealed bearings are 1 mm wider than the outer rings. This is to ensure that the efficiency of the seals is maintained even when small axial displacements of the shaft relative to the housing occur. The inner rings are also provided with a lubrication hole so that the bearings may be relubricated either via the outer ring or via the inner ring, depending on the application.

Fig 6

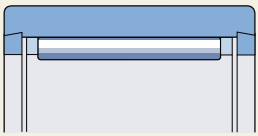


Fig 7

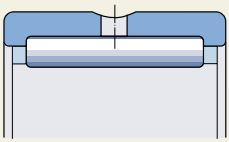


Fig 8

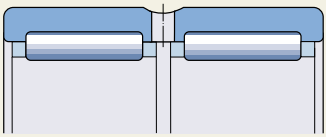


Fig 9

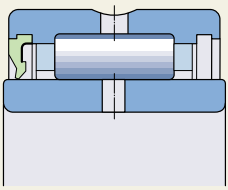
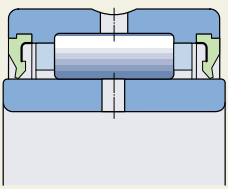


Fig 10



Needle roller bearings without flanges

The needle roller bearings without flanges are 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 considerably facilitates mounting. The needle roller and cage assembly can either be mounted together with the outer ring or with the shaft or inner ring, or it may be inserted between the outer ring and shaft or inner ring as the final step. However, the needle roller and cage assembly of any one bearing must be kept together as supplied; they are not interchangeable with those of other bearings.

SKF bearings without flanges are available as single row (➔ **fig** 11) or double row bearings (➔ **fig** 12). The double row bearings have two needle roller and cage assemblies arranged adjacent to each other. They have an annular groove and lubrication hole in the outer ring to ensure efficient lubrication.

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 surface are given in the product tables.

Dimensions

The boundary dimensions of needle roller bearings of series RNA 48, RNA 49, NA 48 and NA 49 conform to ISO 1206-1982 and those of series NA 69 to ISO 15:1998. The dimensions of the other needle roller bearings listed in the product tables are not standardised but have found general acceptance in industry.

Fig 11

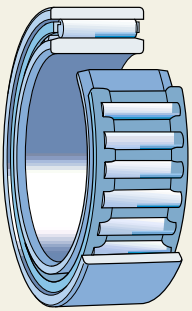
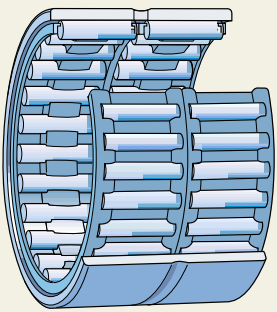


Fig 12



Tolerances

SKF needle roller bearings are produced to Normal tolerances in accordance with ISO 492:1994 as standard.

On request, bearings with higher accuracy to tolerance P6 or P5 specifications can be supplied. For bearing arrangements with heightened accuracy, it is also possible to order inner rings with a preground raceway which is then 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 tolerance F6 before the bearings are mounted.

To order, bearings without inner ring can be supplied with reduced inside diameter tolerances. Such bearings are identified by the designation suffix H followed by a figure combination which gives the actual minimum and maximum values in µm for the deviation from the nominal inside diameter F_w, e.g. +20+24.

Values of the actual tolerances specified for the classes Normal, P6 and P5 will be found in **Tables** 2 to 4 on **pages 17** to **19**.

Internal clearance

SKF needle roller bearings with inner ring are supplied with Normal radial internal clearance as standard (➔ **Table** 6, **page 21**). The clearance values correspond to ISO 5753:1991.

For needle roller bearings without inner ring, a suitable internal clearance is achieved by selecting the appropriate tolerance for the raceway diameter. Recommended values will be found in **Table** 1. The recommendations apply providing the housing bore is machined to a tolerance not tighter than K7.

Misalignment

The modified line contact between the raceways and the rollers serves to prevent damaging edge stresses from occurring and also allows the single row needle roller bearings to accommodate very minor angular misalignments of the shaft relative to the

Table 1

Shaft tolerances for needle roller bearings without inner ring

Nominal inside diameter F_w		Shaft tolerances for shaft raceways to give operational clearance		
		less than normal	normal	greater than normal
over	incl.			
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

housing.

Cages

SKF needle roller bearings are fitted with a steel (➔ **fig** 13) or sheet steel cage (➔ **fig** 14) as standard except for bearings identified by the designation suffix TN. These have an injection moulded glass fibre reinforced polyamide 6,6 cage (➔ **fig** 15).

NB.
Needle roller bearings with polyamide 6,6 cages can be used at temperatures up to +120 °C. With the exception of a few synthetic oils and greases with a synthetic base oil, and lubricants containing a high proportion of EP additives when used at high temperatures, the lubricants generally used for rolling bearings do not have a detrimental effect on cage properties.

For further information regarding the temperature resistance and use of cages, please refer to the section “Cages” (➔ **page 22**).

For bearing arrangements which are to be operated at continuously high temperatures or under arduous conditions, it is recommended that bearings incorporating steel or sheet steel cages be used.

Raceways on the shaft

If the load carrying capacity of bearings without inner ring is to be fully utilised, the raceways on the shaft should be produced to the same quality as that normally used for bearing inner ring raceways. Details of suitable materials, surface finish and hardness will be found in the section “Raceways on shafts

Fig 13

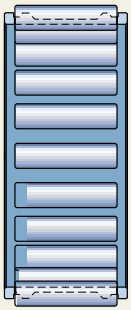


Fig 14

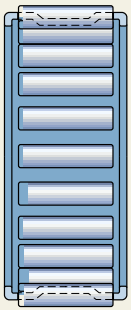
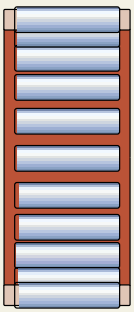


Fig 15



and in housings" (➔ **page 28**).

Minimum load
In order to guarantee satisfactory operation, needle roller bearings, like all ball and roller bearings, must always be subjected to a given minimum load, particularly if they are to operate at high speeds or are subjected to high accelerations or rapid changes in the direction of load. Under such conditions the inertia forces of the needle rollers and cage, and the friction in the lubricant, can have a detrimental influence on the rolling conditions in the bearing arrangement and may cause damaging sliding movements to occur between the rollers and raceways.

The requisite minimum load to be applied to needle roller bearings can be estimated using

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

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

When starting up at low temperatures or when the lubricant is highly viscous, even greater loads may be required. The weights of the components supported by the bearing, together with the external forces, generally exceed the requisite minimum load. If this is not the case, the needle roller bearing must be subjected to an additional radial load.

Equivalent dynamic bearing load
Needle roller bearings can only take radial loads, therefore

$$P = F_r$$

Equivalent static bearing load
Needle roller bearings can only take radial loads, therefore

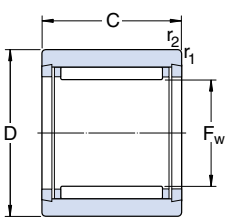
$$P_0 = F_r$$

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

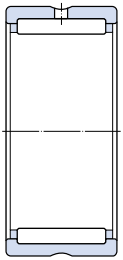
C3 Radial internal clearance greater than Normal
C4 Radial internal clearance greater than C3
H Reduced tolerance for the inside diameter of the roller and cage assembly. The figures following the letter H indicate the tolerance limits in µm
IS1 One lubrication hole in the inner ring
P5 Dimensional and 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 Rubbing seal at one side of bearing
2RS Rubbing seals at both sides of bearing
TN Injection moulded glass fibre reinforced polyamide 6,6 cage
VGS Preground raceway on inner ring

Needle roller bearings with flanges, without inner ring

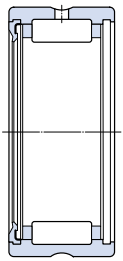
F_w **5 – 17** mm



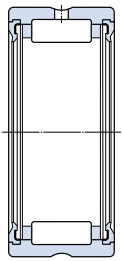
Series NK
($F_w \leq 10$ mm)



Series NK
($F_w \geq 12$ mm)
Series RNA

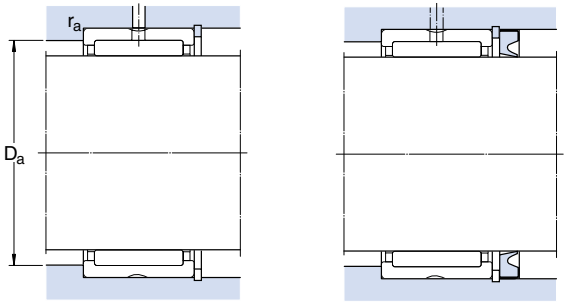


Series RNA 49 RS



Series RNA 49.2RS

Principal dimensions			**Basic load ratings** dynamic	static	**Fatigue load limit**	**Speed ratings** Lubrication grease	oil	**Mass**	**Designation**
F_w	D	C	C	C_0	P_u				
mm			N		N	r/min		kg	–
5	10	10	2 290	2 000	212	36 000	50 000	0,0031	**NK 5/10 TN**
	10	12	2 920	2 700	290	36 000	50 000	0,0037	**NK 5/12 TN**
6	12	10	2 550	2 360	250	32 000	45 000	0,0047	**NK 6/10 TN**
	12	12	3 300	3 200	345	32 000	45 000	0,0057	**NK 6/12 TN**
7	14	10	2 810	2 750	290	30 000	43 000	0,0069	**NK 7/10 TN**
	14	12	3 580	3 750	415	30 000	43 000	0,0082	**NK 7/12 TN**
8	15	12	3 800	4 250	465	28 000	40 000	0,0087	**NK 8/12 TN**
	15	16	5 010	5 850	670	28 000	40 000	0,012	**NK 8/16 TN**
9	16	12	4 400	5 200	570	24 000	36 000	0,010	**NK 9/12 TN**
	16	16	5 720	7 200	815	24 000	36 000	0,013	**NK 9/16 TN**
10	17	12	4 400	5 400	620	22 000	34 000	0,010	**NK 10/12 TN**
	17	16	5 940	8 000	900	22 000	34 000	0,013	**NK 10/16 TN**
12	19	12	6 710	8 150	965	19 000	30 000	0,012	**NK 12/12**
	19	16	9 130	12 000	1 460	19 000	30 000	0,016	**NK 12/16**
14	22	13	8 800	10 400	1 250	17 000	26 000	0,017	**RNA 4900**
	22	13	7 370	8 150	950	13 000	13 000	0,016	**RNA 4900 RS**
	22	13	7 370	8 150	950	13 000	–	0,016	**RNA 4900.2RS**
	22	16	10 200	12 500	1 530	17 000	26 000	0,021	**NK 14/16**
	22	20	12 800	16 600	2 080	17 000	26 000	0,026	**NK 14/20**
15	23	16	11 000	14 000	1 700	16 000	24 000	0,022	**NK 15/16**
	23	20	13 800	18 300	2 280	16 000	24 000	0,027	**NK 15/20**
16	24	13	9 900	12 200	1 460	16 000	24 000	0,017	**RNA 4901**
	24	13	8 090	9 650	1 140	12 000	12 000	0,018	**RNA 4901 RS**
	24	13	8 090	9 650	1 140	12 000	–	0,018	**RNA 4901.2RS**
	24	16	11 700	15 300	1 860	16 000	24 000	0,022	**NK 16/16**
	24	20	14 500	20 000	2 500	16 000	24 000	0,028	**NK 16/20**
	24	22	16 100	23 200	2 900	16 000	24 000	0,031	**RNA 6901**
17	25	16	12 100	16 600	2 000	15 000	22 000	0,024	**NK 17/16**
	25	20	15 100	22 000	2 750	15 000	22 000	0,030	**NK 17/20**

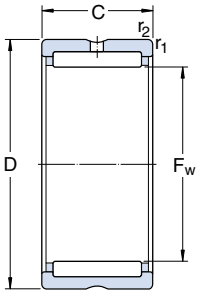


Dimensions		Abutment and fillet dimensions		Appropriate seal[1] Designation
F_w	$r_{1,2}$ min	D_a max	r_a max	
mm		mm		–
5	0,15	8,8	0,1	G 5 × 10 × 2
	0,15	8,8	0,1	G 5 × 10 × 2
6	0,15	10,8	0,1	G 6 × 12 × 2
	0,15	10,8	0,1	G 6 × 12 × 2
7	0,3	12	0,3	G 7 × 14 × 2
	0,3	12	0,3	G 7 × 14 × 2
8	0,3	13	0,3	G/SD 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
17	0,3	23	0,3	G/SD 17 × 25 × 3
	0,3	23	0,3	G/SD 17 × 25 × 3

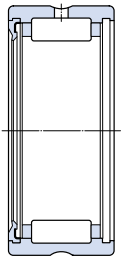
[1] Details of the G and SD seals will be found in the section “Seals” (→ **page 214**)

Needle roller bearings with flanges, without inner ring

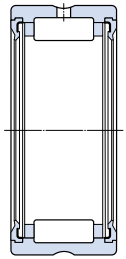
F_w **18 – 26** mm



Series NK
Series RNA 49
Series RNA 69

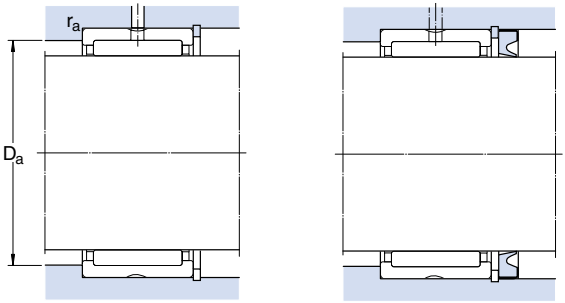


Series RNA 49 RS



Series RNA 49.2RS

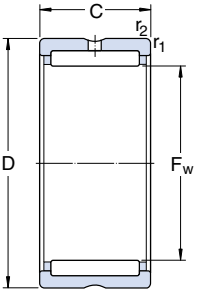
Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Lubrication grease	oil	Mass	Designation
F_w	D	C	C	C_0	P_u				
mm			N		N	r/min		kg	–
18	26	16	12 800	17 600	2 160	15 000	22 000	0,025	**NK 18/16**
	26	20	16 100	23 600	3 000	15 000	22 000	0,031	**NK 18/20**
19	27	16	13 400	19 000	2 320	14 000	20 000	0,026	**NK 19/16**
	27	20	16 500	25 500	3 200	14 000	20 000	0,032	**NK 19/20**
20	28	13	11 200	15 300	1 830	13 000	19 000	0,022	**RNA 4902**
	28	13	9 130	12 000	1 400	9 500	9 500	0,022	**RNA 4902 RS**
	28	13	9 130	12 000	1 400	9 500	–	0,022	**RNA 4902.2RS**
	28	16	13 200	19 300	2 360	13 000	19 000	0,027	**NK 20/16**
	28	20	16 500	25 500	3 200	13 000	19 000	0,034	**NK 20/20**
	28	23	17 200	27 000	3 400	13 000	19 000	0,040	**RNA 6902**
21	29	16	13 800	20 400	2 500	13 000	19 000	0,028	**NK 21/16**
	29	20	17 200	27 000	3 450	13 000	19 000	0,035	**NK 21/20**
22	30	13	11 400	16 300	1 960	12 000	18 000	0,022	**RNA 4903**
	30	13	9 520	12 900	1 500	9 000	9 000	0,023	**RNA 4903 RS**
	30	13	9 520	12 900	1 500	9 000	–	0,023	**RNA 4903.2RS**
	30	16	14 200	21 600	2 650	12 000	18 000	0,030	**NK 22/16**
	30	20	17 900	29 000	3 650	12 000	18 000	0,037	**NK 22/20**
	30	23	18 700	30 500	3 900	12 000	18 000	0,042	**RNA 6903**
24	32	16	15 400	24 500	3 000	10 000	16 000	0,032	**NK 24/16**
	32	20	19 000	32 500	4 050	10 000	16 000	0,040	**NK 24/20**
	37	20	26 000	33 500	4 250	9 500	15 000	0,066	**NKS 24**
25	33	16	15 100	24 500	3 000	10 000	16 000	0,033	**NK 25/16**
	33	20	19 000	32 500	4 150	10 000	16 000	0,042	**NK 25/20**
	37	17	21 600	28 000	3 550	9 500	15 000	0,052	**RNA 4904**
	37	17	19 400	22400	2 750	7 500	7 500	0,056	**RNA 4904 RS**
	37	17	19 400	22 400	2 750	7 500	–	0,056	**RNA 4904.2RS**
	37	30	35 200	53 000	6 950	9 500	15 000	0,10	**RNA 6904**
	38	20	27 500	36 000	4 550	9 500	15 000	0,068	**NKS 25**
26	34	16	15 700	26 000	3 200	9 500	15 000	0,034	**NK 26/16**
	34	20	19 400	34 500	4 300	9 500	15 000	0,042	**NK 26/20**



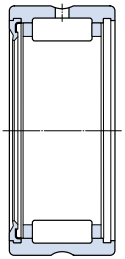
Dimensions		Abutment and fillet dimensions		Appropriate seal[1] Designation
F_w	$r_{1,2}$ min	D_a max	r_a max	
mm		mm		–
18	0,3	24	0,3	G/SD 18 × 26 × 4
	0,3	24	0,3	G/SD 18 × 26 × 4
19	0,3	25	0,3	G/SD 19 × 27 × 4
	0,3	25	0,3	G/SD 19 × 27 × 4
20	0,3	26	0,3	G/SD 20 × 28 × 4
	0,3	26	0,3	–
	0,3	26	0,3	–
	0,3	26	0,3	G/SD 20 × 28 × 4
	0,3	26	0,3	G/SD 20 × 28 × 4
	0,3	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
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	–
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 × 37 × 7 CRW1R
	0,3	35	0,3	–
	0,3	35	0,3	–
	0,3	35	0,3	CR 25 × 37 × 7 CRW1R
	0,6	34	0,6	CR 25 × 38 × 7 CRW1R
26	0,3	32	0,3	G/SD 26 × 34 × 4
	0,3	32	0,3	G/SD 26 × 34 × 4

[1] Details of the G and SD seals will be found in the section "Seals" (➔ **page 214**). The CR seals are described in catalogue 4006 "CR seals"

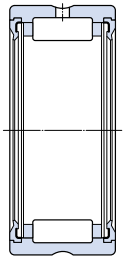
Needle roller bearings with flanges, without inner ring
F_w **28 – 38** mm



Series NK(S)
Series RNA 49
Series RNA 69

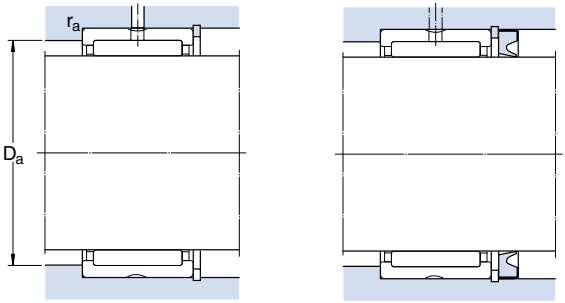


Series RNA 49 RS



Series RNA 49.2RS

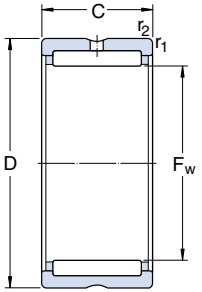
Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Lubrication grease	oil	Mass	Designation
F_w	D	C	C	C_0	P_u				
mm			N		N	r/min		kg	–
28	37	20	22 000	36 500	4 650	9 000	14 000	0,052	**NK 28/20**
	37	30	31 900	60 000	7 800	9 000	14 000	0,082	**NK 28/30**
	39	17	23 300	32 000	4 050	9 000	14 000	0,050	**RNA 49/22**
	39	30	36 900	57 000	7 500	9 000	14 000	0,098	**RNA 69/22**
	42	20	28 600	39 000	5 000	8 500	13 000	0,084	**NKS 28**
29	38	20	22 000	36 500	4 650	9 000	14 000	0,054	**NK 29/20**
	38	30	31 900	60 000	7 800	9 000	14 000	0,084	**NK 29/30**
30	40	20	22 900	38 000	4 900	8 500	13 000	0,065	**NK 30/20**
	40	30	33 000	63 000	8 150	8 500	13 000	0,098	**NK 30/30**
	42	17	24 200	34 500	4 300	8 500	13 000	0,061	**RNA 4905**
	42	17	21 600	27 500	3 350	6 300	6 300	0,060	**RNA 4905 RS**
	42	17	21 600	27 500	3 350	6 300	–	0,060	**RNA 4905.2RS**
	42	30	38 000	62 000	8 150	8 500	13 000	0,11	**RNA 6905**
	45	22	31 900	43 000	5 500	8 000	12 000	0,10	**NKS 30**
32	42	20	23 300	40 500	5 200	8 000	12 000	0,068	**NK 32/20**
	42	30	34 100	65 500	8 650	8 000	12 000	0,10	**NK 32/30**
	45	17	25 100	36 500	4 550	8 000	12 000	0,073	**RNA 49/28**
	45	30	39 600	65 500	8 650	8 000	12 000	0,14	**RNA 69/28**
	47	22	34 100	46 500	6 000	8 000	12 000	0,11	**NKS 32**
35	45	20	24 600	45 000	5 700	7 500	11 000	0,074	**NK 35/20**
	45	30	35 800	72 000	9 500	7 500	11 000	0,11	**NK 35/30**
	47	17	25 500	39 000	4 900	7 500	11 000	0,069	**RNA 4906**
	47	17	23 300	32 000	3 900	5 600	5 600	0,069	**RNA 4906 RS**
	47	17	23 300	32 000	3 900	5 600	–	0,069	**RNA 4906.2RS**
	47	30	42 900	75 000	9 800	7 500	11 000	0,13	**RNA 6906**
	50	22	35 200	50 000	6 400	7 500	11 000	0,12	**NKS 35**
37	47	20	25 100	46 500	5 850	7 500	11 000	0,077	**NK 37/20**
	47	30	36 900	76 500	10 000	7 500	11 000	0,11	**NK 37/30**
	52	22	36 900	54 000	6 950	7 000	10 000	0,12	**NKS 37**
38	48	20	25 500	49 000	6 200	7 500	11 000	0,079	**NK 38/20**
	48	30	37 400	80 000	10 400	7 500	11 000	0,12	**NK 38/30**



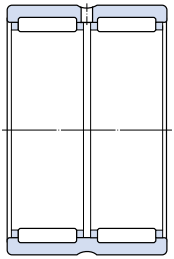
Dimensions		Abutment and fillet dimensions		Appropriate seal[1] Designation
F_w	$r_{1,2}$ min	D_a max	r_a max	
mm		mm		–
28	0,3	35	0,3	G/SD 28 × 37 × 4
	0,3	35	0,3	G/SD 28 × 37 × 4
	0,3	37	0,3	–
	0,3	37	0,3	–
	0,3	38	0,6	CR 28 × 42 × 7 CRW1R
29	0,3	36	0,3	G/SD 29 × 38 × 4
	0,3	36	0,3	G/SD 29 × 38 × 4
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 CRW1R
	0,3	40	0,3	–
	0,3	40	0,3	–
	0,3	40	0,3	CR 30 × 42 × 7 CRW1R
	0,6	41	0,6	CR 30 × 45 × 8 CRW1R
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 CRW1R
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 CRW1R
	0,3	45	0,3	–
	0,3	45	0,3	–
	0,3	45	0,3	CR 35 × 47 × 7 CRW1R
	0,6	46	0,6	CR 35 × 50 × 8 CRW1R
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

[1] Details of the G and SD seals will be found in the section “Seals” (➔ **page 214**). The CR seals are described in catalogue 4006 “CR seals”

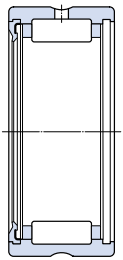
Needle roller bearings with flanges, without inner ring
F_w **40 – 52** mm



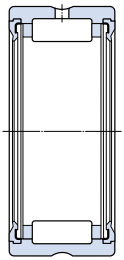
Series NK(S)
Series RNA 49



Series RNA 69

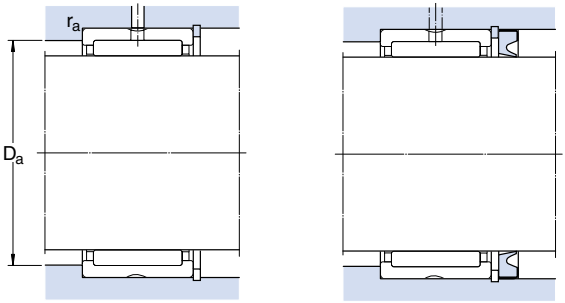


Series RNA 49 RS



Series RNA 49.2RS

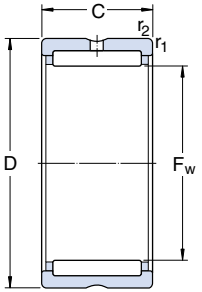
Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Lubrication grease	oil	Mass	Designation
F_w	D	C	C	C_0	P_u				
mm			N		N	r/min		kg	–
40	50	20	26 400	51 000	6 400	7 000	10 000	0,083	**NK 40/20**
	50	30	38 000	83 000	10 800	7 000	10 000	0,13	**NK 40/30**
	52	20	30 800	51 000	6 550	7 000	10 000	0,089	**RNA 49/32**
	52	36	47 300	90 000	11 200	7 000	10 000	0,16	**RNA 69/32**
	55	22	38 000	57 000	7 350	6 700	9 500	0,13	**NKS 40**
42	52	20	27 000	53 000	6 700	6 700	9 500	0,086	**NK 42/20**
	52	30	39 100	86 500	11 200	6 700	9 500	0,13	**NK 42/30**
	55	20	31 900	54 000	6 950	6 700	9 500	0,11	**RNA 4907**
	55	20	27 000	43 000	5 400	4 800	4 800	0,11	**RNA 4907 RS**
	55	20	27 000	43 000	5 400	4 800	–	0,11	**RNA 4907.2RS**
	55	36	48 400	93 000	11 800	6 700	9 500	0,19	**RNA 6907**
43	53	20	27 500	55 000	6 950	6 700	9 500	0,086	**NK 43/20**
	53	30	40 200	90 000	11 600	6 700	9 500	0,13	**NK 43/30**
	58	22	39 100	61 000	7 800	6 300	9 000	0,14	**NKS 43**
45	55	20	27 500	57 000	7 200	6 300	9 000	0,092	**NK 45/20**
	55	30	40 200	93 000	12 000	6 300	9 000	0,14	**NK 45/30**
	60	22	40 200	64 000	8 300	6 000	8 500	0,15	**NKS 45**
47	57	20	29 200	61 000	7 650	6 000	8 500	0,095	**NK 47/20**
	57	30	41 800	98 000	12 900	6 000	8 500	0,14	**NK 47/30**
48	62	22	42 900	71 000	9 150	5 600	8 000	0,14	**RNA 4908**
	62	22	36 900	58 500	7 350	4 000	4 000	0,15	**RNA 4908 RS**
	62	22	36 900	58 500	7 350	4 000	–	0,15	**RNA 4908.2RS**
	62	40	67 100	125 000	16 000	5 600	8 000	0,26	**RNA 6908**
50	62	25	38 000	78 000	10 000	5 600	8 000	0,16	**NK 50/25**
	62	35	49 500	110 000	14 300	5 600	8 000	0,22	**NK 50/35**
	65	22	42 900	72 000	9 150	5 600	8 000	0,16	**NKS 50**
52	68	22	45 700	78 000	10 000	5 300	7 500	0,18	**RNA 4909**
	68	22	39 100	64 000	8 000	3 800	3 800	0,16	**RNA 4909 RS**
	68	22	39 100	64 000	8 000	3 800	–	0,16	**RNA 4909.2RS**
	68	40	70 400	137 000	17 300	5 300	7 500	0,34	**RNA 6909**



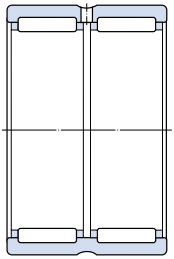
Dimensions		Abutment and fillet dimensions		Appropriate seal[1] Designation
F_w	$r_{1,2}$ min	D_a max	r_a max	
mm		mm		–
40	0,3	48	0,3	G/SD 40 × 50 × 4
	0,3	48	0,3	G/SD 40 × 50 × 4
	0,6	48	0,6	G/SD 40 × 52 × 5
	0,6	48	0,6	G/SD 40 × 52 × 5
	0,6	51	0,6	CR 40 × 55 × 8 CRW1R
42	0,3	50	0,3	G/SD 42 × 52 × 4
	0,3	50	0,3	G/SD 42 × 52 × 4
	0,6	51	0,6	CR 42 × 55 × 8 CRW1R
	0,6	51	0,6	–
	0,6	51	0,6	–
	0,6	51	0,6	CR 42 × 55 × 8 CRW1R
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 CRW1R
47	0,3	55	0,3	–
	0,3	55	0,3	–
48	0,6	58	0,6	CR 48 × 62 × 8 CRW1R
	0,6	58	0,6	–
	0,6	58	0,6	–
	0,6	58	0,6	CR 48 × 62 × 8 CRW1R
50	0,6	58	0,6	G/SD 50 × 62 × 4
	0,6	58	0,6	G/SD 50 × 62 × 4
	1	60	1	CR 50 × 65 × 8 CRW1R
52	0,6	64	0,6	CR 52 × 68 × 8 CRW1R
	0,6	64	0,6	–
	0,6	64	0,6	–
	0,6	64	0,6	CR 52 × 68 × 8 CRW1R

[1] Details of the G and SD seals will be found in the section “Seals” (➔ **page 214**). The CR seals are described in catalogue 4006 “CR seals”

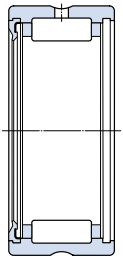
Needle roller bearings with flanges, without inner ring
F_w **55 – 75** mm



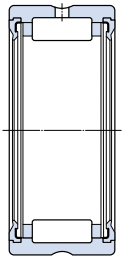
Series NK(S)
Series RNA 49



Series RNA 69

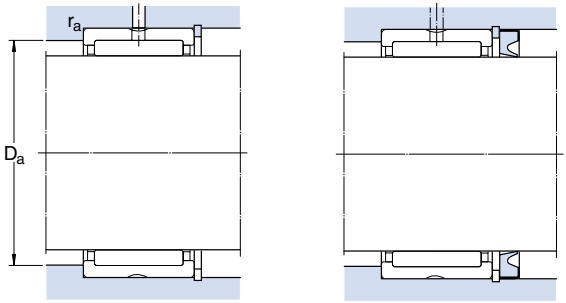


Series RNA 49 RS



Series RNA 49.2RS

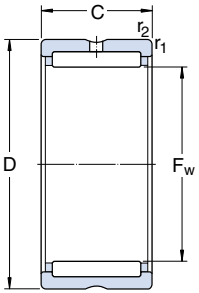
Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Lubrication grease	oil	Mass	Designation
F_w	D	C	C	C_0	P_u				
mm			N		N	r/min		kg	–
55	68	25	40 200	88 000	11 200	5 300	7 500	0,18	**NK 55/25**
	68	35	52 300	122 000	16 000	5 300	7 500	0,25	**NK 55/35**
	72	22	44 600	78 000	10 000	5 000	7 000	0,22	**NKS 55**
58	72	22	47 300	85 000	11 000	5 000	7 000	0,16	**RNA 4910**
	72	22	40 200	69 500	8 800	3 400	3 400	0,16	**RNA 4910 RS**
	72	22	40 200	69 500	8 800	3 400	–	0,16	**RNA 4910.2RS**
	72	40	73 700	150 000	19 000	5 000	7 000	0,31	**RNA 6910**
60	72	25	41 800	96 500	12 200	4 800	6 700	0,19	**NK 60/25**
	72	35	55 000	134 000	17 600	4 800	6 700	0,26	**NK 60/35**
	80	28	62 700	104 000	13 700	4 500	6 300	0,34	**NKS 60**
63	80	25	57 200	106 000	13 700	4 500	6 300	0,26	**RNA 4911**
	80	45	89 700	190 000	24 000	4 500	6 300	0,47	**RNA 6911**
65	78	25	44 000	104 000	13 200	4 500	6 300	0,22	**NK 65/25**
	78	35	58 300	146 000	19 300	4 500	6 300	0,31	**NK 65/35**
	85	28	66 000	114 000	15 000	4 300	6 000	0,36	**NKS 65**
68	82	25	44 000	95 000	12 000	4 300	6 000	0,24	**NK 68/25**
	82	35	60 500	146 000	19 000	4 300	6 000	0,34	**NK 68/35**
	85	25	60 500	114 000	14 600	4 300	6 000	0,28	**RNA 4912**
	85	45	93 500	204 000	26 000	4 300	6 000	0,49	**RNA 6912**
70	85	25	44 600	98 000	12 500	4 300	6 000	0,26	**NK 70/25**
	85	35	61 600	150 000	19 600	4 300	6 000	0,37	**NK 70/35**
	90	28	68 200	120 000	15 600	4 000	5 600	0,38	**NKS 70**
72	90	25	61 600	120 000	15 300	4 000	5 600	0,31	**RNA 4913**
	90	45	95 200	212 000	27 000	4 000	5 600	0,58	**RNA 6913**
73	90	25	52 800	106 000	13 700	4 000	5 600	0,30	**NK 73/25**
	90	35	73 700	163 000	21 600	4 000	5 600	0,43	**NK 73/35**
75	92	25	53 900	110 000	14 000	3 800	5 300	0,32	**NK 75/25**
	92	35	74 800	170 000	22 000	3 800	5 300	0,45	**NK 75/35**
	95	28	70 400	132 000	17 000	3 800	5 300	0,40	**NKS 75**



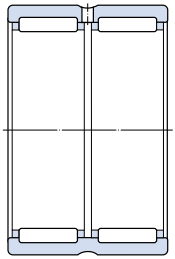
Dimensions		Abutment and fillet dimensions		Appropriate seal[1] Designation
F_w	$r_{1,2}$ min	D_a max	r_a max	
mm		mm		–
55	0,6	64	0,6	–
	0,6	64	0,6	–
	1	67	1	CR 55 × 72 × 8 CRW1R
58	0,6	68	0,6	CR 58 × 72 × 8 CRW1R
	0,6	68	0,6	–
	0,6	68	0,6	–
	0,6	68	0,6	CR 58 × 72 × 8 CRW1R
60	0,6	68	0,6	–
	0,6	68	0,6	–
	1,1	73,5	1	–
63	1	75	1	CR 63 × 80 × 8 CRW1R
	1	75	1	CR 63 × 80 × 8 CRW1R
65	0,6	74	0,6	–
	0,6	74	0,6	–
	1,1	78,5	1	CR 65 × 85 × 8 CRW1R
68	0,6	78	0,6	–
	0,6	78	0,6	–
	1	80	1	CR 68 × 85 × 8 CRW1R
	1	80	1	CR 68 × 85 × 8 CRW1R
70	0,6	81	0,6	CR 70 × 85 × 8 CRW1R
	0,6	81	0,6	CR 70 × 85 × 8 CRW1R
	1,1	83,5	1	CR 70 × 95 × 10 CRW1R
72	1	85	1	CR 72 × 90 × 10 CRSH1R
	1	85	1	CR 72 × 90 × 10 CRSH1R
73	1	85	1	–
	1	85	1	–
75	1	87	1	–
	1	87	1	–
	1,1	88,5	1	CR 75 × 95 × 10 CRW1R

[1] The CR seals are described in catalogue 4006 “CR seals”

Needle roller bearings with flanges, without inner ring
F_w **80 – 130** mm

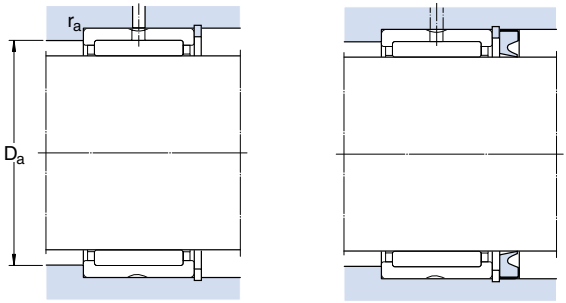


Series NK
Series RNA 48
Series RNA 49



Series RNA 69

Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Lubrication grease	oil	Mass	Designation
F_w	D	C	C	C_0	P_u				
mm			N		N	r/min		kg	–
80	95	25	56 100	127 000	16 000	3 600	5 000	0,30	**NK 80/25**
	95	35	76 500	190 000	25 000	3 600	5 000	0,43	**NK 80/35**
	100	30	84 200	163 000	21 600	3 600	5 000	0,46	**RNA 4914**
	100	54	128 000	285 000	37 500	3 600	5 000	0,86	**RNA 6914**
85	105	25	69 300	132 000	17 000	3 400	4 800	0,43	**NK 85/25**
	105	30	84 200	170 000	22 400	3 400	4 800	0,49	**RNA 4915**
	105	35	96 800	200 000	27 000	3 400	4 800	0,60	**NK 85/35**
	105	54	130 000	290 000	38 000	3 400	4 800	0,94	**RNA 6915**
90	110	25	72 100	140 000	18 300	3 200	4 500	0,45	**NK 90/25**
	110	30	88 000	183 000	24 000	3 200	4 500	0,52	**RNA 4916**
	110	35	101 000	216 000	29 000	3 200	4 500	0,63	**NK 90/35**
	110	54	134 000	315 000	41 500	3 200	4 500	0,99	**RNA 6916**
95	115	26	73 700	146 000	19 000	3 000	4 300	0,49	**NK 95/26**
	115	36	105 000	232 000	30 500	3 000	4 300	0,68	**NK 95/36**
100	120	26	76 500	156 000	19 600	2 800	4 000	0,52	**NK 100/26**
	120	35	108 000	250 000	32 000	2 800	4 000	0,66	**RNA 4917**
	120	36	108 000	250 000	32 000	2 800	4 000	0,72	**NK 100/36**
	120	63	165 000	425 000	54 000	2 800	4 000	1,20	**RNA 6917**
105	125	26	78 100	166 000	20 800	2 600	3 800	0,54	**NK 105/26**
	125	35	112 000	265 000	33 500	2 600	3 800	0,75	**RNA 4918**
	125	36	112 000	265 000	33 500	2 600	3 800	0,71	**NK 105/36**
	125	63	172 000	450 000	57 000	2 600	3 800	1,35	**RNA 6918**
110	130	30	96 800	220 000	27 500	2 400	3 600	0,65	**NK 110/30**
	130	35	114 000	270 000	34 000	2 400	3 600	0,72	**RNA 4919**
	130	40	123 000	305 000	38 000	2 400	3 600	0,83	**NK 110/40**
	130	63	172 000	465 000	57 000	2 400	3 600	1,45	**RNA 6919**
115	140	40	125 000	280 000	34 500	2 200	3 400	1,15	**RNA 4920**
120	140	30	93 500	232 000	27 500	2 200	3 400	0,67	**RNA 4822**
125	150	40	130 000	300 000	36 500	2 000	3 200	1,25	**RNA 4922**
130	150	30	99 000	255 000	30 000	2 000	3 200	0,73	**RNA 4824**

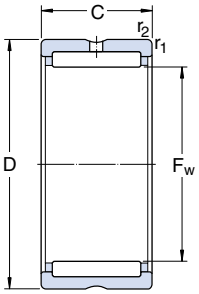


Dimensions		Abutment and fillet dimensions		Appropriate seal[1)] Designation
F_w	$r_{1,2}$ min	D_a max	r_a max	
mm		mm		–
80	1	90	1	–
	1	90	1	–
	1	95	1	CR 80 × 100 × 10 CRW1R
	1	95	1	CR 80 × 100 × 10 CRW1R
85	1	100	1	CR 85 × 105 × 10 CRW1R
	1	100	1	CR 85 × 105 × 10 CRW1R
	1	100	1	CR 85 × 105 × 10 CRW1R
	1	100	1	CR 85 × 105 × 10 CRW1R
90	1	105	1	CR 90 × 110 × 12 CRW1R
	1	105	1	CR 90 × 110 × 12 CRW1R
	1	105	1	CR 90 × 110 × 12 CRW1R
	1	105	1	CR 90 × 110 × 12 CRW1R
95	1	110	1	CR 95 × 115 × 12 CRW1R
	1	110	1	CR 95 × 115 × 12 CRW1R
100	1	115	1	CR 100 × 120 × 12 CRW1R
	1,1	113,5	1	CR 100 × 120 × 12 CRW1R
	1	115	1	CR 100 × 120 × 12 CRW1R
	1,1	113,5	1	CR 100 × 120 × 12 CRW1R
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 CRW1R
	1,1	123,5	1	CR 110 × 130 × 12 CRW1R
	1,1	123,5	1	CR 110 × 130 × 12 CRW1R
	1,1	123,5	1	CR 110 × 130 × 12 CRW1R
115	1,1	133,5	1	CR 115 × 140 × 12 CRW1R
120	1	135	1	CR 120 × 140 × 13 HMS4R
125	1,1	143,5	1	CR 125 × 150 × 12 CRW1R
130	1	145	1	–

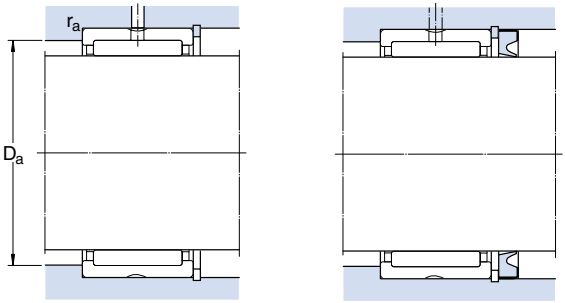
[1)] The CR seals are described in catalogue 4006 “CR seals”

Needle roller bearings with flanges, without inner ring

F_w **135 – 415** mm



Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Lubrication grease	oil	Mass	Designation
F_w	D	C	C	C_0	P_u				
mm			N		N	r/min		kg	–
135	165	45	176 000	405 000	47 500	1 900	3 000	1,85	**RNA 4924**
145	165	35	119 000	325 000	37 500	1 800	2 800	0,99	**RNA 4826**
150	180	50	198 000	480 000	55 000	1 700	2 600	2,20	**RNA 4926**
155	175	35	121 000	345 000	38 000	1 700	2 600	1,05	**RNA 4828**
160	190	50	205 000	510 000	58 500	1 600	2 400	2,35	**RNA 4928**
165	190	40	147 000	415 000	46 500	1 600	2 400	1,60	**RNA 4830**
175	200	40	157 000	450 000	50 000	1 500	2 200	1,70	**RNA 4832**
185	215	45	179 000	520 000	57 000	1 500	2 200	2,55	**RNA 4834**
195	225	45	190 000	570 000	60 000	1 400	2 000	2,70	**RNA 4836**
210	240	50	220 000	710 000	73 500	1 300	1 900	3,20	**RNA 4838**
220	250	50	224 000	735 000	75 000	1 200	1 800	3,35	**RNA 4840**
240	270	50	238 000	815 000	81 500	1 100	1 700	3,60	**RNA 4844**
265	300	60	347 000	1 120 000	108 000	950	1 500	5,40	**RNA 4848**
285	320	60	358 000	1 200 000	114 000	900	1 400	5,80	**RNA 4852**
305	350	69	429 000	1 320 000	127 000	850	1 300	9,30	**RNA 4856**
330	380	80	594 000	1 800 000	170 000	750	1 100	12,5	**RNA 4860**
350	400	80	605 000	1 900 000	176 000	750	1 100	13,5	**RNA 4864**
370	420	80	616 000	1 960 000	180 000	700	1 000	14,0	**RNA 4868**
390	440	80	627 000	2 040 000	186 000	670	950	15,0	**RNA 4872**
415	480	100	968 000	3 000 000	265 000	630	900	26,0	**RNA 4876**

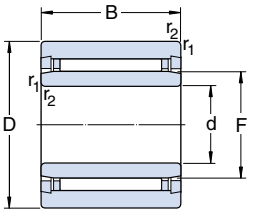


Dimensions		Abutment and fillet dimensions		Appropriate seal[1)] Designation
F_w	$r_{1,2}$ min	D_a max	r_a max	
mm		mm		–
135	1,1	158,5	1	–
145	1,1	158,5	1	CR 145 × 165 × 13 CRSH1R
150	1,5	1172	1,5	CR 150 × 180 × 12 HMS4R
155	1,1	168,5	1	–
160	1,5	182	1,5	CR 160 × 190 × 15 CRW1V
165	1,1	183,5	1	–
175	1,1	193,5	1	–
185	1,1	208,5	1	–
195	1,1	218,5	1	–
210	1,5	232	1,5	–
220	1,5	242	1,5	CR 220 × 250 × 15 HMS4R
240	1,5	262	1,5	CR 240 × 270 × 16 HDS1R
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 HDS1R
370	2,1	409	2	CR 370 × 420 × 25 HDS1R
390	2,1	429	2	–
415	2,1	469	2	–

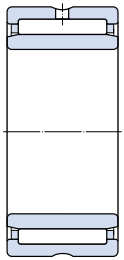
[1)] The CR seals are described in catalogue 4006 “CR seals”

Needle roller bearings with flanges, with inner ring

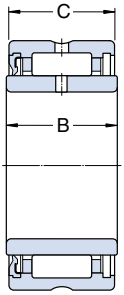
d **5 – 17** mm



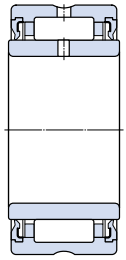
Series NKI
(d ≤ 7 mm)



Series NKI(S) (d ≥ 9 mm)
Series NA 49
Series NA 69

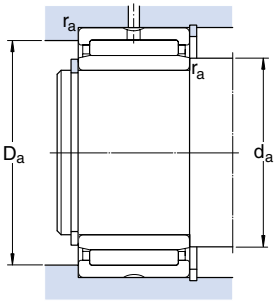


Series NA 49 RS



Series NA 49.2RS

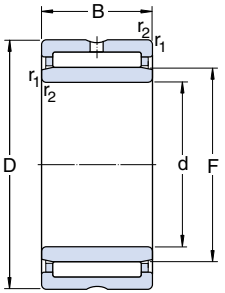
Principal dimensions				Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Lubrication grease	oil	Mass	Designation
d	D	B	C	C	C_0	P_u				
mm				N		N	r/min		kg	–
5	15	12	–	3 800	4 250	465	28 000	40 000	0,012	**NKI 5/12 TN**
	15	16	–	5 010	5 850	670	28 000	40 000	0,015	**NKI 5/16 TN**
6	16	12	–	4 400	5 200	570	24 000	36 000	0,014	**NKI 6/12 TN**
	16	16	–	5 720	7 200	815	24 000	36 000	0,017	**NKI 6/16 TN**
7	17	12	–	4 570	5 700	630	22 000	34 000	0,014	**NKI 7/12 TN**
	17	16	–	5 940	8 000	900	22 000	34 000	0,018	**NKI 7/16 TN**
9	19	12	–	6 710	8 150	965	19 000	30 000	0,017	**NKI 9/12**
	19	16	–	9 130	12 000	1 460	19 000	30 000	0,022	**NKI 9/16**
10	22	13	–	8 800	10 400	1 250	17 000	26 000	0,023	**NA 4900**
	22	14	13	7 370	8 150	950	13 000	13 000	0,025	**NA 4900 RS**
	22	14	13	7 370	8 150	950	13 000	–	0,025	**NA 4900.2RS**
	22	16	–	10 200	12 500	1 530	17 000	26 000	0,029	**NKI 10/16**
	22	20	–	12 800	16 600	2 080	17 000	26 000	0,037	**NKI 10/20**
12	24	13	–	9 900	12 200	1 460	16 000	24 000	0,026	**NA 4901**
	24	14	13	8 090	9 650	1 140	12 000	12 000	0,028	**NA 4901 RS**
	24	14	13	8 090	9 650	1 140	12 000	–	0,028	**NA 4901.2RS**
	24	16	–	11 700	15 300	1 860	16 000	24 000	0,033	**NKI 12/16**
	24	20	–	14 500	20 000	2 500	16 000	24 000	0,042	**NKI 12/20**
	24	20	–	16 100	23 200	2 900	16 000	24 000	0,046	**NA 6901**
15	27	16	–	13 400	19 000	2 320	14 000	20 000	0,039	**NKI 15/16**
	27	20	–	16 500	25 500	3 200	14 000	20 000	0,049	**NKI 15/20**
	28	13	–	11 200	15 300	1 830	13 000	19 000	0,034	**NA 4902**
	28	14	13	9 130	12 000	1 400	9 500	9 500	0,037	**NA 4902 RS**
	28	14	13	9 130	12 000	1 400	9 500	–	0,037	**NA 4902.2RS**
	28	23	–	17 200	27 000	3 400	13 000	19 000	0,064	**NA 6902**
17	29	16	–	13 800	20 400	2 500	13 000	19 000	0,042	**NKI 17/16**
	29	20	–	17 200	27 000	3 450	13 000	19 000	0,053	**NKI 17/20**
	30	13	–	11 400	16 300	1 960	12 000	18 000	0,037	**NA 4903**
	30	14	13	9 520	12 900	1 500	9 000	9 000	0,040	**NA 4903 RS**
	30	14	13	9 520	12 900	1 500	9 000	–	0,040	**NA 4903.2RS**
	30	23	–	18 700	30 500	3 900	12 000	18 000	0,072	**NA 6903**
	37	20	–	26 000	33 500	4 250	9 500	15 000	0,098	**NKIS 17**



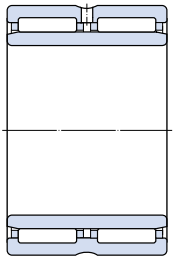
Dimensions				Abutment and fillet dimensions		
d	F	$r_{1,2}$ min	s[1]	d_a min	D_a max	r_a max
mm				mm		
5	8	0,3	1,5	7	13	0,3
	8	0,3	2	7	13	0,3
6	9	0,3	1,5	8	14	0,3
	9	0,3	2	8	14	0,3
7	10	0,3	1,5	9	15	0,3
	10	0,3	2	9	15	0,3
9	12	0,3	1,5	11	17	0,3
	12	0,3	2	11	17	0,3
10	14	0,3	0,5	12	20	0,3
	14	0,3	0,5	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
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 in relation to the other

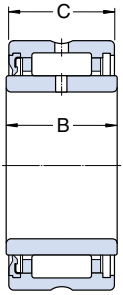
Needle roller bearings with flanges, with inner ring
d **20 – 32** mm



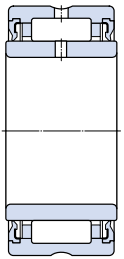
Series NKI(S)
Series NA 49
Series NA 69 (d ≤ 30 mm)



Series NA 69
(d ≥ 32 mm)

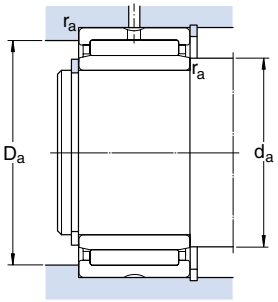


Series NA 49 RS



Series NA 49.2RS

Principal dimensions				Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Lubrication grease	oil	Mass	Designation
d	D	B	C	C	C_0	P_u				
mm				N		N	r/min		kg	–
20	32	16	–	15 400	24 500	3 000	10 000	16 000	0,049	**NKI 20/16**
	32	20	–	19 000	32 500	4 050	10 000	16 000	0,061	**NKI 20/20**
	37	17	–	21 600	28 000	3 550	9 500	15 000	0,075	**NA 4904**
	37	18	17	19 400	22 400	2 750	7 500	7 500	0,080	**NA 4904 RS**
	37	18	17	19 400	22 400	2 750	7 500	–	0,080	**NA 4904.2RS**
	37	30	–	35 200	53 000	6 950	9 500	15 000	0,14	**NA 6904**
	42	20	–	28 600	39 000	5 000	8 500	13 000	0,13	**NKIS 20**
22	34	16	–	15 700	26 000	3 200	9 500	15 000	0,052	**NKI 22/16**
	34	20	–	19 400	34 500	4 300	9 500	15 000	0,065	**NKI 22/20**
	39	17	–	23 300	32 000	4 050	9 000	14 000	0,080	**NA 49/22**
	39	30	–	36 900	57 000	7 500	9 000	14 000	0,15	**NA 69/22**
25	38	20	–	22 000	36 500	4 650	9 000	14 000	0,079	**NKI 25/20**
	38	30	–	31 900	60 000	7 800	9 000	14 000	0,12	**NKI 25/30**
	42	17	–	24 200	34 500	4 300	8 500	13 000	0,088	**NA 4905**
	42	18	17	21 600	27 500	3 350	6 300	6 300	0,090	**NA 4905 RS**
	42	18	17	21 600	27 500	3 350	6 300	–	0,090	**NA 4905.2RS**
	42	30	–	38 000	62 000	8 150	8 500	13 000	0,16	**NA 6905**
	47	22	–	34 100	46 500	6 000	8 000	12 000	0,16	**NKIS 25**
28	42	20	–	23 300	40 500	5 200	8 000	12 000	0,097	**NKI 28/20**
	42	30	–	34 100	65 500	8 650	8 000	12 000	0,15	**NKI 28/30**
	45	17	–	25 100	36 500	4 550	8 000	12 000	0,098	**NA 49/28**
	45	30	–	39 600	65 500	8 650	8 000	12 000	0,18	**NA 69/28**
30	45	20	–	24 600	45 000	5 700	7 500	11 000	0,11	**NKI 30/20**
	45	30	–	35 800	72 000	9 500	7 500	11 000	0,17	**NKI 30/30**
	47	17	–	25 500	39 000	4 900	7 500	11 000	0,10	**NA 4906**
	47	18	17	23 300	32 000	3 900	5 600	5 600	0,10	**NA 4906 RS**
	47	18	17	23 300	32 000	3 900	5 600	–	0,10	**NA 4906.2RS**
	47	30	–	42 900	75 000	9 800	7 500	11 000	0,19	**NA 6906**
	52	22	–	36 000	54 000	6 950	7 000	10 000	0,18	**NKIS 30**
32	47	20	–	25 100	46 500	5 850	7 500	11 000	0,12	**NKI 32/20**
	47	30	–	36 900	76 500	10 000	7 500	11 000	0,18	**NKI 32/30**
	52	20	–	30 800	51 000	6 550	7 000	10 000	0,16	**NA 49/32**
	52	36	–	47 300	90 000	11 200	7 000	10 000	0,29	**NA 69/32**

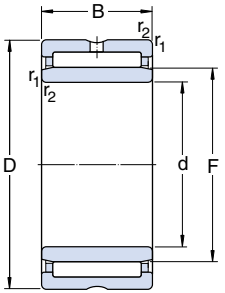


Dimensions				Abutment and fillet dimensions		
d	F	$r_{1,2}$ min	s[1]	d_a min	D_a max	r_a max
mm				mm		
20	24	0,3	0,5	22	30	0,3
	24	0,3	0,5	22	30	0,3
	25	0,3	0,8	22	35	0,3
	25	0,3	0,5	22	35	0,3
	25	0,3	0,5	22	35	0,3
	25	0,3	1	22	35	0,3
	28	0,6	0,5	24	38	0,6
22	26	0,3	0,5	24	32	0,3
	26	0,3	0,5	24	32	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

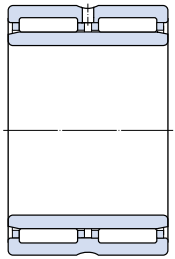
[1] Permissible axial displacement from normal position of one bearing ring in relation to the other

Needle roller bearings with flanges, with inner ring

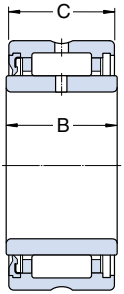
d **35 – 50** mm



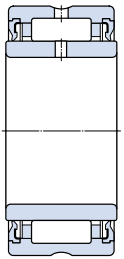
Series NKI(S)
Series NA 49



Series NA 69

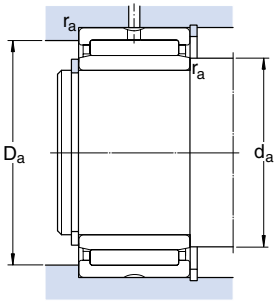


Series NA 49 RS



Series NA 49.2RS

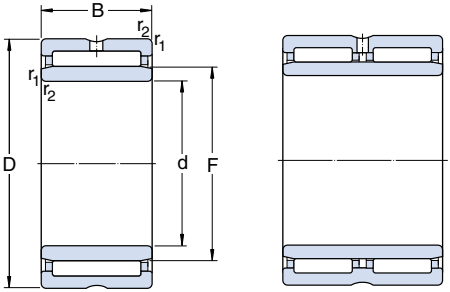
Principal dimensions				Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Lubrication grease	oil	Mass	Designation
d	D	B	C	C_0	P_u					
mm				N		N	r/min		kg	–
35	50	20	–	26 400	51 000	6 400	7 000	10 000	0,13	**NKI 35/20**
	50	30	–	38 000	83 000	10 800	7 000	10 000	0,19	**NKI 35/30**
	55	20	–	31 900	54 000	6 950	6 700	9 500	0,17	**NA 4907**
	55	21	20	27 000	43 000	5 400	4 800	4 800	0,18	**NA 4907 RS**
	55	21	20	27 000	43 000	5 400	4 800	–	0,18	**NA 4907.2RS**
	55	36	–	48 400	93 000	11 800	6 700	9 500	0,31	**NA 6907**
	58	22	–	39 100	61 000	7 800	6 300	9 000	0,22	**NKIS 35**
38	53	20	–	27 500	55 000	6 950	6 700	9 500	0,14	**NKI 38/20**
	53	30	–	40 200	90 000	11 600	6 700	9 500	0,21	**NKI 38/30**
40	55	20	–	27 500	57 000	7 200	6 300	9 000	0,14	**NKI 40/20**
	55	30	–	40 200	93 000	12 000	6 300	9 000	0,22	**NKI 40/30**
	62	22	–	42 900	71 000	9 150	5 600	8 000	0,23	**NA 4908**
	62	23	22	36 900	58 500	7 350	4 000	4 000	0,25	**NA 4908 RS**
	62	23	22	36 900	58 500	7 350	4 000	–	0,25	**NA 4908.2RS**
	62	40	–	67 100	125 000	16 000	5 600	8 000	0,43	**NA 6908**
	65	22	–	42 900	72 000	9 150	5 600	8 000	0,28	**NKIS 40**
42	57	20	–	29 200	61 000	7 650	6 000	8 500	0,15	**NKI 42/20**
	57	30	–	41 800	98 000	12 900	6 000	8 500	0,22	**NKI 42/30**
45	62	25	–	38 000	78 000	10 000	5 600	8 000	0,23	**NKI 45/25**
	62	35	–	49 500	110 000	14 300	5 600	8 000	0,32	**NKI 45/35**
	68	22	–	45 700	78 000	10 000	5 300	7 500	0,27	**NA 4909**
	68	23	22	39 100	64 000	8 000	3 800	3 800	0,29	**NA 4909 RS**
	68	23	22	39 100	64 000	8 000	3 800	–	0,29	**NA 4909.2RS**
	68	40	–	70 400	137 000	17 300	5 300	7 500	0,50	**NA 6909**
	72	22	–	44 600	78 000	10 000	5 000	7 000	0,34	**NKIS 45**
50	68	25	–	40 200	88 000	11 200	5 300	7 500	0,27	**NKI 50/25**
	68	35	–	52 300	122 000	16 000	5 300	7 500	0,38	**NKI 50/35**
	72	22	–	47 300	85 000	11 000	5 000	7 000	0,27	**NA 4910**
	72	23	22	40 200	69 500	8 800	3 400	3 400	0,30	**NA 4910 RS**
	72	23	22	40 200	69 500	8 800	3 400	–	0,30	**NA 4910.2RS**
	72	40	–	73 700	150 000	19 000	5 000	7 000	0,52	**NA 6910**
	80	28	–	62 700	104 000	13 700	4 500	6 300	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

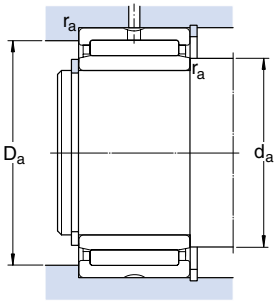
Needle roller bearings with flanges, with inner ring
d **55 – 85** mm



Series NKI(S)
Series NA 49

Series NA 69

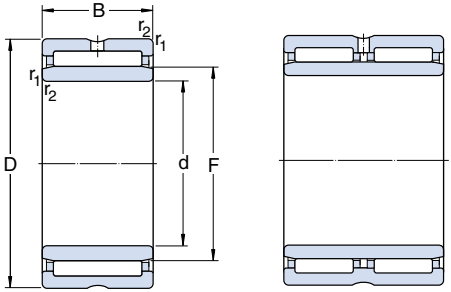
Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Lubrication grease	oil	Mass	Designation
d	D	B	C	C_0	P_u				
mm			N		N	r/min		kg	–
55	72	25	41 800	96 500	12 200	4 800	6 700	0,27	**NKI 55/25**
	72	35	55 000	134 000	17 600	4 800	6 700	0,38	**NKI 55/35**
	80	25	57 200	106 000	13 700	4 500	6 300	0,39	**NA 4911**
	80	45	89 700	190 000	24 000	4 500	6 300	0,78	**NA 6911**
	85	28	66 000	114 000	15 000	4 300	6 000	0,56	**NKIS 55**
60	82	25	44 000	95 000	12 000	4 300	6 000	0,39	**NKI 60/25**
	82	35	60 500	146 000	19 000	4 300	6 000	0,55	**NKI 60/35**
	85	25	60 500	114 000	14 600	4 300	6 000	0,43	**NA 4912**
	85	45	93 500	204 000	26 000	4 300	6 000	0,81	**NA 6912**
	90	28	68 200	120 000	15 600	4 000	5 600	0,56	**NKIS 60**
65	90	25	61 600	120 000	15 300	4 000	5 600	0,46	**NA 4913**
	90	45	95 200	212 000	27 000	4 000	5 600	0,83	**NA 6913**
	90	25	52 800	106 000	13 700	4 000	5 600	0,47	**NKI 65/25**
	90	35	73 700	163 000	21 600	4 000	5 600	0,66	**NKI 65/35**
	95	28	70 400	132 000	17 000	3 800	5 300	0,64	**NKIS 65**
70	95	25	56 100	127 000	16 000	3 600	5 000	0,52	**NKI 70/25**
	95	35	76 500	190 000	25 000	3 600	5 000	0,74	**NKI 70/35**
	100	30	84 200	163 000	21 600	3 600	5 000	0,73	**NA 4914**
	100	54	128 000	285 000	37 500	3 600	5 000	1,35	**NA 6914**
75	105	25	69 300	132 000	17 000	3 400	4 800	0,64	**NKI 75/25**
	105	30	84 200	170 000	22 400	3 400	4 800	0,78	**NA 4915**
	105	35	96 800	200 000	27 000	3 400	4 800	0,91	**NKI 75/35**
	105	54	130 000	290 000	38 000	3 400	4 800	1,45	**NA 6915**
80	110	25	72 100	140 000	18 300	3 200	4 500	0,68	**NKI 80/25**
	110	30	88 000	183 000	24 000	3 200	4 500	0,88	**NA 4916**
	110	35	101 000	216 000	29 000	3 200	4 500	0,96	**NKI 80/35**
	110	54	134 000	315 000	41 500	3 200	4 500	1,50	**NA 6916**
85	115	26	73 700	146 000	19 000	3 000	4 300	0,74	**NKI 85/26**
	115	36	105 000	232 000	30 500	3 000	4 300	1,05	**NKI 85/36**
	120	35	108 000	250 000	32 000	2 800	4 000	1,25	**NA 4917**
	120	63	165 000	425 000	54 000	2 800	4 000	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
	72	1	1,5	70	85	1
	73	1	1	70	85	1
	73	1	1	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

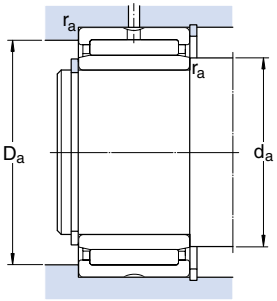
Needle roller bearings with flanges, with inner ring
d **90 – 220** mm



Series NKI
Series NA 49

Series NA 69

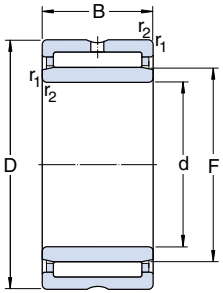
Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Lubrication grease	oil	Mass	Designation
d	D	B	C	C_0	P_u				
mm			N		N	r/min		kg	–
90	120	26	76 500	156 000	19 600	2 800	4 000	0,78	**NKI 90/26**
	120	36	108 000	250 000	32 000	2 800	4 000	1,10	**NKI 90/36**
	125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



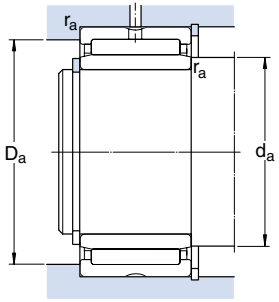
Dimensions				Abutment and fillet dimensions		
d	F	$r_{1,2}$ min	s[1]	d_a min	D_a max	r_a max
mm				mm		
90	100	1	1,5	95	115	1
	100	1	1,5	95	115	1
	105	1,1	1	96,5	118,5	1
	105	1,1	1	96,5	118,5	1
95	105	1	1,5	100	120	1
	105	1	1,5	100	120	1
	110	1,1	1	101,5	123,5	1
	110	1,1	1	101,5	123,5	1
100	110	1,1	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 flanges, with inner ring
d **240 – 380** mm



Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Lubrication grease	oil	Mass	Designation
d	D	B	C	C_0	P_u				
mm			N		N	r/min		kg	–
240	300	60	347 000	1 120 000	108 000	950	1 500	10,0	**NA 4848**
260	320	60	358 000	1 200 000	114 000	900	1 400	10,5	**NA 4852**
280	350	69	429 000	1 320 000	127 000	850	1 300	15,5	**NA 4856**
300	380	80	594 000	1 800 000	170 000	750	1 100	22,0	**NA 4860**
320	400	80	605 000	1 900 000	176 000	750	1 100	23,0	**NA 4864**
340	420	80	616 000	1 960 000	180 000	700	1 000	24,0	**NA 4868**
360	440	80	627 000	2 040 000	186 000	670	950	25,5	**NA 4872**
380	480	100	968 000	3 000 000	265 000	630	900	42,5	**NA 4876**

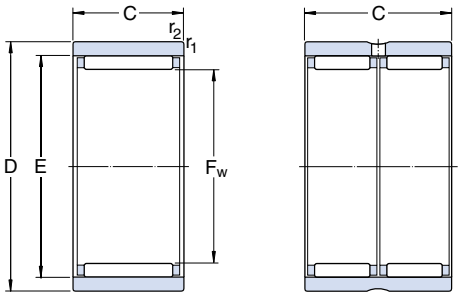


Dimensions				Abutment and fillet dimensions		
d	F	$r_{1,2}$ min	s[1]	d_a min	D_a max	r_a max
mm				mm		
240	265	2	2	249	291	2
260	285	2	2	269	311	2
280	305	2	2,5	289	341	2
300	330	2,1	2	311	369	2
320	350	2,1	2	331	389	2
340	370	2,1	2	351	409	2
360	390	2,1	2	371	429	2
380	415	2,1	2	391	469	2

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

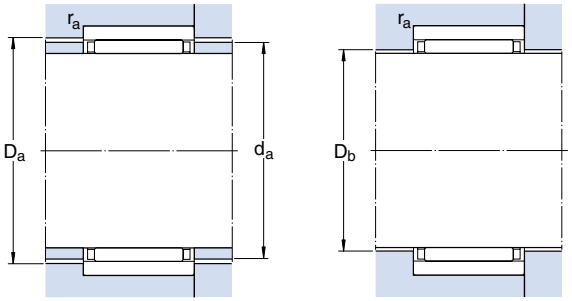
Needle roller bearings without flanges, without inner ring

F_w **5 – 30** mm



Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Lubrication grease	oil	Mass	Designation
F_w	D	C	C	C_0	P_u				
mm			N		N	r/min		kg	–
5	10	8	2 290	2 000	212	24 000	36 000	0,003	**RNAO 5×10×8 TN**
6	13	8	2 550	2 360	250	22 000	34 000	0,006	**RNAO 6×13×8 TN**
7	14	8	2 810	2 750	290	20 000	32 000	0,006	**RNAO 7×14×8 TN**
8	15	10	3 800	4 250	465	20 000	32 000	0,008	**RNAO 8×15×10 TN**
10	17	10	4 570	5 700	630	19 000	30 000	0,010	**RNAO 10×17×10 TN**
12	22	12	9 520	10 000	1 180	17 000	26 000	0,019	**RNAO 12×22×12 TN**
15	23	13	8 090	10 800	1 250	16 000	24 000	0,020	**RNAO 15×23×13**
16	24	13	8 580	12 000	1 370	16 000	24 000	0,021	**RNAO 16×24×13**
	28	12	11 000	12 500	1 500	15 000	22 000	0,032	**RNAO 16×28×12**
17	25	13	10 100	14 600	1 730	15 000	22 000	0,022	**RNAO 17×25×13**
18	30	24	20 900	30 000	3 600	14 000	20 000	0,069	**RNAO 18×30×24**[1]
20	28	13	9 520	14 600	1 660	14 000	20 000	0,025	**RNAO 20×28×13**
	28	26	16 100	29 000	3 350	14 000	20 000	0,050	**RNAO 20×28×26**[1]
	32	12	12 800	16 300	1 960	13 000	19 000	0,038	**RNAO 20×32×12**
22	30	13	10 100	16 300	1 860	12 000	18 000	0,027	**RNAO 22×30×13**
	35	16	19 400	25 500	3 050	11 000	17 000	0,059	**RNAO 22×35×16**
25	35	17	14 200	26 500	3 100	10 000	16 000	0,053	**RNAO 25×35×17**
	35	26	18 700	37 500	4 300	10 000	16 000	0,076	**RNAO 25×35×26**[1]
	37	16	20 100	28 000	3 350	9 500	15 000	0,060	**RNAO 25×37×16**
30	40	17	18 700	34 000	4 050	8 500	13 000	0,060	**RNAO 30×40×17**
	42	16	22 000	33 500	4 000	8 500	13 000	0,059	**RNAO 30×42×16**
	42	32	38 000	67 000	8 000	8 500	13 000	0,14	**RNAO 30×42×32**[1]

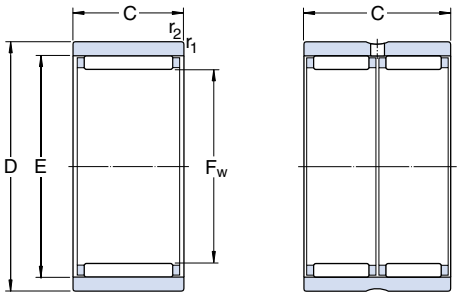
[1] Double row



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	0,3	19,6	20,3	16,4	0,3
	22	0,3	21,6	22,3	16,4	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	0,3	23,6	24,3	20,4	0,3
	24	0,3	23,6	24,3	20,4	0,3
	26	0,3	25,6	26,5	20,4	0,3
22	26	0,3	25,6	26,3	22,4	0,3
	29	0,3	28,4	29,5	22,4	0,3
25	30	0,3	29,4	30,5	25,6	0,3
	30	0,3	29,4	30,5	25,6	0,3
	32	0,3	31,4	32,5	25,6	0,3
30	35	0,3	34,4	35,5	30,6	0,3
	37	0,3	36,4	37,5	30,6	0,3
	37	0,3	36,4	37,5	30,6	0,3

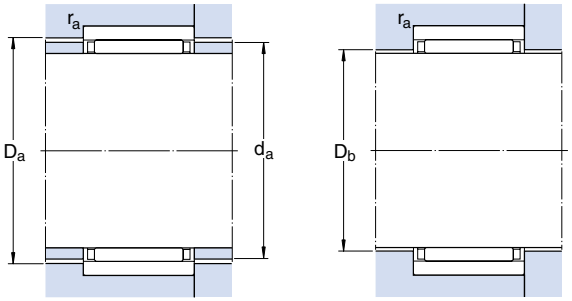
Needle roller bearings without flanges, without inner ring

F_w **35 – 100** mm



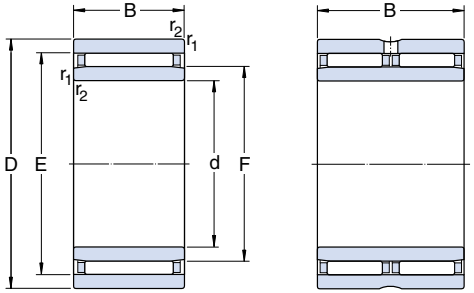
Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Lubrication grease	oil	Mass	Designation
F_w	D	C	C	C_0	P_u				
mm			N		N	r/min		kg	–
35	45	13	15 400	28 000	3 250	8 000	12 000	0,053	**RNAO 35×45×13**
	45	17	19 800	39 000	4 650	8 000	12 000	0,069	**RNAO 35×45×17**
	45	26	26 400	56 000	6 550	8 000	12 000	0,091	**RNAO 35×45×26** [1]
	47	16	23 300	37 500	4 500	7 500	11 000	0,078	**RNAO 35×47×16**
	47	18	26 400	44 000	5 300	7 500	11 000	0,089	**RNAO 35×47×18**
	47	32	40 200	75 000	9 000	7 500	11 000	0,16	**RNAO 35×47×32** [1]
40	50	17	20 500	41 500	5 000	7 000	10 000	0,074	**RNAO 40×50×17**
	50	34	35 200	83 000	10 000	7 000	10 000	0,15	**RNAO 40×50×34** [1]
	55	20	31 400	57 000	6 950	7 000	10 000	0,15	**RNAO 40×55×20**
	55	40	59 400	118 000	14 600	7 000	10 000	0,28	**RNAO 40×55×40** [1]
45	55	17	21 600	46 500	5 600	6 300	9 000	0,083	**RNAO 45×55×17**
	62	40	64 400	137 000	16 600	6 300	9 000	0,38	**RNAO 45×62×40** [1]
50	62	20	25 500	60 000	7 200	6 000	8 500	0,14	**RNAO 50×62×20**
	65	20	34 100	62 000	7 650	5 600	8 000	0,17	**RNAO 50×65×20**
	65	40	58 300	125 000	15 300	5 600	8 000	0,36	**RNAO 50×65×40**
55	68	20	27 000	67 000	8 150	5 300	7 500	0,17	**RNAO 55×68×20**
60	78	20	41 800	86 500	10 600	4 800	6 700	0,26	**RNAO 60×78×20**
	78	40	72 100	173 000	21 200	4 800	6 700	0,44	**RNAO 60×78×40**
65	85	30	53 900	125 000	15 600	4 500	6 300	0,46	**RNAO 65×85×30**
70	90	30	57 200	137 000	17 000	4 300	6 000	0,50	**RNAO 70×90×30**
80	100	30	68 200	176 000	22 000	3 600	5 000	0,58	**RNAO 80×100×30**
90	105	26	58 300	150 000	18 600	3 200	4 500	0,37	**RNAO 90×105×26**
	110	30	64 400	173 000	21 600	3 200	4 500	0,61	**RNAO 90×110×30**
100	120	30	67 100	190 000	23 600	2 800	4 000	0,69	**RNAO 100×120×30**

[1] Double row



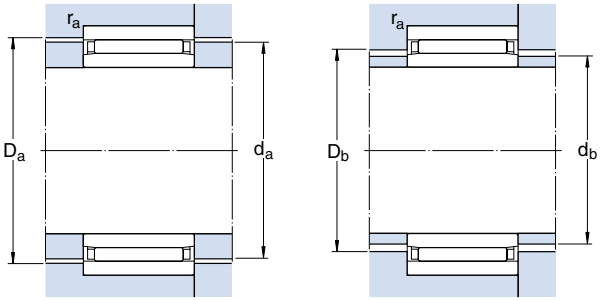
Dimensions			Abutment and fillet dimensions			
F_w	E	$r_{1,2}$ min	d_a	D_a	D_b	r_a max
mm			mm			
35	40	0,3	39,4	40,5	35,6	0,3
	40	0,3	39,4	40,5	35,6	0,3
	40	0,3	39,4	40,5	35,6	0,3
	42	0,3	41,4	42,5	35,8	0,3
	42	0,3	41,4	42,5	35,6	0,3
	42	0,3	41,4	42,5	35,6	0,3
40	45	0,3	44,4	45,5	40,6	0,3
	45	0,3	44,4	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 without flanges, with inner ring
d **6 – 90** mm



Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Lubrication grease	oil	Mass	Designation
d	D	B	C	C_0	P_u				
mm			N		N	r/min		kg	–
6	17	10	4 570	5 700	630	18 000	28 000	0,014	**NAO 6×17×10 TN**[1]
9	22	12	9 520	10 000	1 180	17 000	26 000	0,024	**NAO 9×22×12 TN**
12	24	13	8 580	12 000	1 370	16 000	24 000	0,030	**NAO 12×24×13**
	28	12	11 000	12 500	1 500	15 000	22 000	0,040	**NAO 12×28×12**
15	28	13	9 520	14 600	1 660	14 000	20 000	0,029	**NAO 15×28×13**
	32	12	12 800	16 300	1 960	13 000	19 000	0,050	**NAO 15×32×12**[1]
17	30	13	10 100	16 300	1 860	12 000	18 000	0,042	**NAO 17×30×13**
	35	16	19 400	25 500	3 050	11 000	17 000	0,078	**NAO 17×35×16**
20	35	17	14 200	26 500	3 100	10 000	16 000	0,076	**NAO 20×35×17**
	37	16	20 100	28 000	3 350	9 500	15 000	0,082	**NAO 20×37×16**
25	40	17	18 700	34 000	4 050	8 500	13 000	0,088	**NAO 25×40×17**
	42	16	22 000	33 500	4 000	8 500	13 000	0,086	**NAO 25×42×16**[1]
	42	32	38 000	68 000	8 150	8 500	13 000	0,19	**NAO 25×42×32**[2]
30	45	17	19 800	39 000	4 650	8 000	12 000	0,10	**NAO 30×45×17**
	45	26	26 400	56 000	6 550	8 000	12 000	0,16	**NAO 30×45×26**[2]
	47	16	23 300	37 500	4 500	7 500	11 000	0,11	**NAO 30×47×16**
	47	18	26 400	44 000	5 300	7 500	11 000	0,12	**NAO 30×47×18**
35	50	17	20 500	41 500	5 000	7 000	10 000	0,11	**NAO 35×50×17**
	55	20	31 400	57 000	6 950	7 000	10 000	0,19	**NAO 35×55×20**
40	55	17	21 600	46 500	5 600	6 300	9 000	0,13	**NAO 40×55×17**
50	68	20	27 000	67 000	8 150	5 300	7 500	0,23	**NAO 50×68×20**[1]
70	100	30	68 200	176 000	22 000	3 600	5 000	0,85	**NAO 70×100×30**
80	110	30	64 400	173 000	21 600	3 200	4 500	0,92	**NAO 80×110×30**
90	120	30	67 100	190 000	23 600	2 800	4 000	1,05	**NAO 90×120×30**

[1] With one lubrication hole in the inner ring
[2] Double row



Dimensions					Abutment and fillet dimensions				
d	E	F	$r_{1,2}$ min	s[1]	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

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


SKF

Alignment needle roller bearings

Product tables

Alignment needle roller bearings without inner ring ..... **page 112**
Alignment needle roller bearings with inner ring ..... **page 114**

SKF alignment needle roller bearings have an outer ring with a convex sphered outside surface. A plastic seating ring having a concave sphered inside surface and encased in a drawn sheet steel sleeve is fitted over the outer ring, thus enabling the bearing to align itself. Alignment needle roller bearings are therefore insensitive to errors of alignment of the shaft relative to the housing. They are mounted with an interference fit in the housing bore. No shoulders or retaining rings etc. are required to locate the bearings axially so that the housing bore can be simply and economically machined.

Alignment needle roller bearings can be supplied without inner ring (➔ **fig** 1) or with inner ring (➔ **fig** 2). Bearings without inner ring provide the optimum solution for arrangements where the shaft can be hardened and ground. Where this is not possible or not economic bearings with inner ring should be used. Bearings with inner ring only permit axial displacement of the shaft relative to the housing within certain limits. If greater axial displacements can occur extended inner rings, which are wider than the standard inner rings can be used; details will be found in the section “Inner rings” (➔ **page 204**). The extended inner rings should also be used if the inner ring raceway is to serve as a counterface for a seal adjacent to the bearing.

All alignment needle roller bearings have a form-stable steel cage with adequate free space for lubricant. The needle rollers are

Fig 1

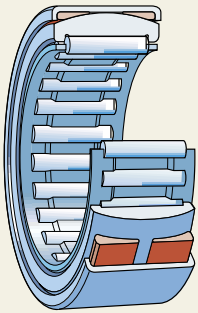
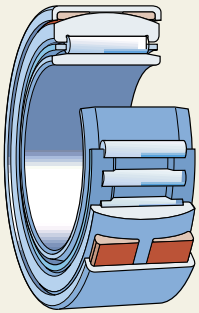


Fig 2



slightly relieved at their ends. The resulting modified line contact between rollers and raceways mean that the stress distribution in the bearing is improved.

Dimensions
The dimensions of alignment needle roller bearings have not been standardised. However, the bore and outside diameters of the smaller sizes follow Diameter Series 0 and those of the larger sizes follow Diameter Series 9 according to ISO 15:1998.

Tolerances
The inner ring and outer ring with sphered outside surface are made to Normal tolerances in accordance with ISO 492:1994 (**→ Table** 2, **page 17**).

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

Internal clearance
Alignment needle roller bearings with inner ring are supplied with Normal radial internal clearance as standard as specified in ISO 5753:1991 (**→Table** 6, **page 21**).

For the bearings without inner ring, series RPNA, the inside diameter F_w of the roller complement when the rollers are in contact with the outer ring raceway lies within tolerance F6 when the bearings are in the unmounted condition. If the recommended raceway tolerances are applied (**→** "Shaft and housing tolerances") the clearance in the bearing arrangement will be normal.

Misalignment
Alignment needle roller bearings can compensate for initial errors of alignment between shaft and housing of up to approximately 3°. They are not suitable for the accommodation of tilting or wobbling movement, however.

Permissible operating temperature
The plastic seating ring material limits the operating temperature range for alignment needle roller bearings to between –30 and +100 °C.

Cages
SKF alignment needle roller bearings are fitted with a steel (**→ fig** 3) or sheet steel cage (**→ fig** 4).

Shaft and housing tolerances
Alignment needle roller bearings should have an interference fit in the housing bore. If the recommended housing bore tolerances (**→ Table** 1) are applied alignment movements between the outer ring and the outer sleeve will be possible. These tolerances, together with the tolerances recommended for the inner ring shaft seatings or for raceways on the shaft will give the bearings a normal operational radial internal clearance.

Fig 3

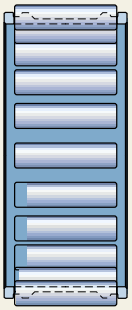
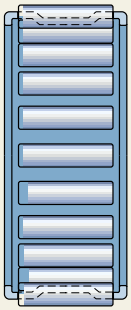


Fig 4



Raceways on the shaft

If the full load carrying capacity of the alignment needle roller bearings without inner ring is to be exploited, the raceways on the shaft must have the hardness and surface finish normally found on bearing raceways. Recommendations for suitable materials, surface roughness and hardness will be found in the section “Raceways on shafts and in housings” (➔ **page 28**).

Mounting instructions

When mounting alignment needle roller bearings, any inner rings are separable and should be mounted separately. The outer ring with sleeve and needle roller and cage assembly should be mounted with the aid of a mandrel as shown in (➔ **fig 5**). An O-ring provides a simple means of retaining the bearing on the mandrel. The stamped (hardened) side face of the sleeve should preferably abut the flange of the mandrel. Care should be taken to see that the sleeve does not tilt as it is pressed into the housing bore.

Fig 5

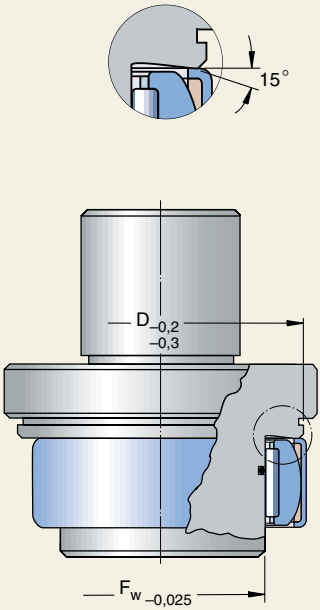


Table 1

Shaft and housing tolerances

Housing material	Tolerances Seating in housing bore	Shaft seating for inner ring	Raceway on shaft
Steel, cast iron	N6 N7	k5 j6	h5 h6
Light alloy	R6 R7	k5 j6	h5 h6

Minimum load
In order to guarantee satisfactory operation, alignment needle roller bearings, like all ball and roller bearings, must always be subjected to a given minimum load, particularly if they are to operate at high speeds or are subjected to high accelerations or rapid changes in the direction of load. Under such conditions the inertia forces of the needle rollers and cage, and the friction in the lubricant, can have a detrimental influence on the rolling conditions in the bearing arrangement and may cause damaging sliding movements to occur between the rollers and raceways.

The requisite minimum radial load to be applied to alignment needle roller bearings can be estimated using

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

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

When starting up at low temperatures or when the lubricant is highly viscous, even greater loads may be required. The weights of the components supported by the bearing, together with the external forces, generally exceed the requisite minimum load. If this is not the case, the alignment needle roller bearing must be subjected to an additional radial load.

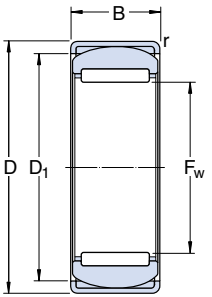
Equivalent dynamic bearing load
Alignment needle roller bearings can only take radial loads, therefore

$$P = F_r$$

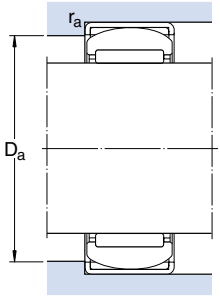
Equivalent static bearing load
Alignment needle roller bearings can only take radial loads, therefore

$$P_0 = F_r$$

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

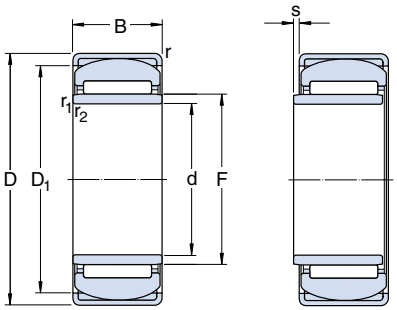


Principal dimensions			**Basic load ratings** dynamic	static	**Fatigue load limit**	**Speed ratings** Lubrication grease	oil	**Mass**	**Designation**
F_w	D	B	C	C_0	P_u				
mm			N		N	r/min		kg	–
15	28	12	7 370	9 150	1 080	16 000	24 000	0,032	**RPNA 15/28**
18	32	16	12 800	17 600	2 120	15 000	22 000	0,052	**RPNA 18/32**
20	35	16	13 200	19 300	2 280	13 000	19 000	0,062	**RPNA 20/35**
25	42	20	19 000	32 500	4 000	10 000	16 000	0,11	**RPNA 25/42**
28	44	20	22 000	36 500	4 550	9 000	14 000	0,11	**RPNA 28/44**
30	47	20	22 900	38 000	4 800	8 500	13 000	0,13	**RPNA 30/47**
35	52	20	24 600	45 000	5 600	7 500	11 000	0,13	**RPNA 35/52**
40	55	20	26 400	51 000	6 300	7 000	10 000	0,14	**RPNA 40/55**
45	62	20	27 500	57 000	7 100	6 300	9 000	0,18	**RPNA 45/62**

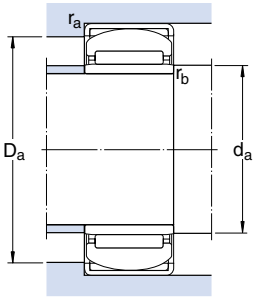


Dimensions			Abutment and fillet dimensions		
F_w	D_1	r min	D_a min	D_a max	r_a max
mm			mm		
15	24,5	1	23,5	24,5	1
18	27	1	26	27	1
20	30,5	1	29,5	30,5	1
25	36,5	1	35	37	1
28	38,5	1	37,5	39	1
30	42	1	41	42	1
35	47,5	1	46,5	47,5	1
40	50,5	1	49,5	50,5	1
45	58	1	57	58	1

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



Principal dimensions			Basic load ratings dynamic	static	Fatigue load limit	Speed ratings Lubrication grease	oil	Mass	Designation
d	D	B	C	C_0	P_u				
mm			N		N	r/min		kg	–
12	28	12	7 370	9 150	1 080	16 000	24 000	0,037	**PNA 12/28**
15	32	16	12 800	17 600	2 120	15 000	22 000	0,062	**PNA 15/32**
17	35	16	13 200	19 300	2 280	13 000	19 000	0,073	**PNA 17/35**
20	42	20	19 000	32 500	4 000	10 000	16 000	0,14	**PNA 20/42**
22	44	20	22 000	36 500	4 550	9 000	14 000	0,15	**PNA 22/44**
25	47	20	22 900	38 000	4 800	8 500	13 000	0,16	**PNA 25/47**
30	52	20	24 600	45 000	5 600	7 500	11 000	0,18	**PNA 30/52**
35	55	20	26 400	51 000	6 300	7 000	10 000	0,18	**PNA 35/55**
40	62	20	27 500	57 000	7 100	6 300	9 000	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

Product tables ..... **page 124**

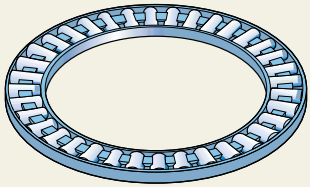
SKF needle roller thrust bearings can support heavy axial loads, are insensitive to shock loads and provide stiff bearing arrangements which require a minimum of axial space. They are single direction bearings and can only accommodate axial loads acting in one direction. Particularly compact bearing arrangements can be made, taking up no more space than a conventional thrust washer, if the faces of adjacent machine components can serve as raceways for a needle roller and cage thrust assembly. For applications where adjacent components cannot serve as raceways, the assemblies can also be combined with washers of various designs.

Because of all the possible combinations, all bearing components must be ordered separately.

Needle roller and cage thrust assemblies

Needle roller and cage thrust assemblies (→ **fig 1**) consist of a form-stable cage which reliably guides and retains a large number of needle rollers. The needle rollers of one assembly have only very slight diameter deviations; the cylindrical surface of the rollers is slightly relieved towards the ends, thus ensuring an even load distribution and preventing damaging edge loads from occurring.

Fig 1



Bearing washers

Raceway washers, series LS

Raceway washers of the LS series (→ **fig** 2) are made of carbon chromium (rolling bearing) steel and are hardened. The raceways are ground and the bore and outside diameter are turned. They may be used both as shaft and as housing washers for bearing arrangements where accurate centring of the washers is not needed or where low speeds are involved.

Thrust washers, series AS

Thrust washers of the AS series (→ **fig** 3) are only 1 mm thick and are made of spring steel. The washers are hardened and polished. They enable very economic bearing arrangements to be produced in cases, where the adjacent machine components are not suitable as raceways, but do have adequate stiffness, and running accuracy requirements are only moderate. The thrust washers can be used both as shaft and as housing washers.

Bearing washers, series WS 811 and GS 811

In addition to the above mentioned LS raceway washers and AS thrust washers, needle roller and cage thrust assemblies can also be combined with the WS shaft washers and GS housing washers (→ **fig** 4) of cylindrical roller thrust bearings of series 811. The use of these shaft and housing washers is recommended, for example, for operation 1at high speeds when accurate centring of the bearing washers is required. The dimensions and designations of these washers are included in the product tables.

Fig 2

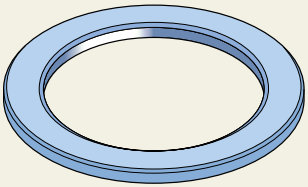


Fig 3

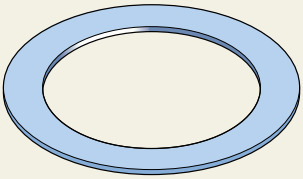
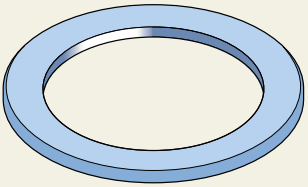


Fig 4



Double direction bearings

By combining intermediate washers, needle roller and cage assemblies of series AXK and the bearing washers (already described) it is possible to assemble double direction needle roller thrust bearings with internal centring (➔ **fig** 5) or with external centring (➔ **fig** 6).

The intermediate washers must have the same surface finish and hardness as the bearing washers (➔ "Design of associated components", **page 122**). Recommendations regarding suitable dimensions for the intermediate washers will be supplied on request.

Dimensions

The dimensions of the needle roller and cage thrust assemblies correspond to ISO 3031-1979. The dimensions of the AS thrust washers follow the same standard.

The bore and outside diameters of the other bearing washers are in accordance with ISO 104:1994, for thrust bearings of Diameter Series 1.

Fig 5

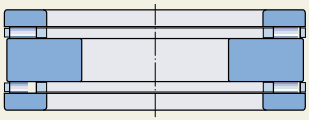
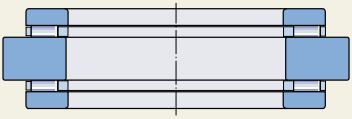


Fig 6



Tolerances

The needle roller and cage thrust assemblies and all the bearings washers are produced to the tolerances listed in **Table 1**. The values for the Normal tolerances to ISO 199:1997 are given in **Table 5**, **page 20**, and the grades of the needle rollers in **Table 1**, **page 211**. The values for the dimension deviations of the various ISO tolerance grades are given in **Table 2**.

Misalignment

Needle roller thrust bearings cannot tolerate any angular misalignment between shaft and housing, nor any errors of alignment between the support surfaces in the housing and on the shaft.

Table 1

Tolerances for needle roller thrust bearings

Bearing component Dimensions		Tolerance
Needle roller and cage thrust assemblies, AXK		
Bore diameter	d	E12
Outside diameter	D	c13
Roller diameter	D_w	G2, ISO 6193-1980
Raceway washers, LS		
Bore diameter	d	E12
Outside diameter	D	a12
Thickness	B	h11
Axial runout	s_i	Normal, ISO 199
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
Outside diameter	d_1	–
Thickness	B	h11
Axial runout	s_i	Normal, ISO 199
Housing washer, GS 811		
Outside diameter	D	Normal, ISO 199
Bore diameter	D_1	–
Thickness	B	h11
Axial runout	s_e	Normal, ISO 199

Table 2

ISO tolerances

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

Cages
SKF needle roller and cage thrust assemblies incorporate a form-stable cage of steel (➔ **fig** 7) or sheet steel (➔ **fig** 8) as standard, with the exception of those assemblies identified by the designation suffix TN which have an injection moulded cage of glass fibre reinforced polyamide 6,6 (➔ **fig** 9).

NB.
Needle roller and cage thrust assemblies with polyamide 6,6 cages can be used at temperatures up to +120 °C. With the exception of a few synthetic oils and greases with a synthetic base oil, and lubricants containing a high proportion of EP additives when used at high temperatures, the lubricants generally used for rolling bearings do not have a detrimental effect on cage properties.

For further information regarding the temperature resistance and use of cages, please refer to the section “Cages” (➔ **page 22**).

For bearing arrangements which are to be operated at continuously high temperatures or under arduous conditions, it is recommended that assemblies incorporating steel or sheet steel cages be used.

Fig 7



Fig 8



Fig 9



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 whole extent and width of the raceways. When thrust washers of series AS are used, the dimensions E_a and E_b (given in the product tables) should be applied.

Suitable tolerances for shafts and housings which are known to provide satisfactory radial guidance for the individual thrust bearing components will be found in **Table 3**.

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 on the shaft and the guiding surface must be ground.

Raceways on the shaft and in the housing

Raceways on the shaft and in the housing should have the same hardness and surface finish as normally used for bearing raceways, if the load carrying capacity of the needle roller and cage thrust assemblies is to be fully exploited. Details regarding suitable materials as well as surface hardness and surface finish will be found in the section “Raceways on shafts and in housings” (➔ **page 28**). The raceways machined on the shaft and in the housing should have the same axial runout as are normal for shaft and housing washers. The values for the permissible axial runout for shaft and housing washers of thrust bearings are given in (➔ **Table 5** on **page 20**).

Table 3

Shaft med housing tolerances

Bearing component		**Shaft tolerance** Internal guidance/ centring	**Housing tolerance** External guidance/ centring
Needle roller and cage thrust assemblies	AXK	h8	–
Raceway washers	LS	h8 –	– H9
Thrust washers	AS	h8 –	– H9
Shaft washers	WS 811	h8	–
Housing washers	GS 811	–	H9

Minimum load
In order to guarantee satisfactory performance, needle roller thrust bearings, like all ball and roller bearings, must always be subjected to a given minimum load, particularly if they are to operate at high speeds or are subjected to high accelerations or rapid changes in the direction of load. Under such conditions the inertia forces of the needle rollers and cage, and the friction in the lubricant, can have a detrimental effect on the rolling conditions in the bearing arrangement and may cause damaging sliding movements to occur between the rollers and raceways.

The requisite minimum axial load to be applied to needle roller thrust bearings can be estimated using

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

where
F_{am} = minimum axial load, N
C_0 = basic static load rating, N

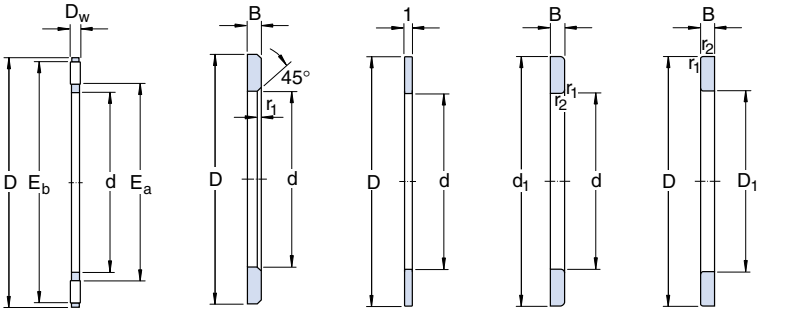
When starting up at low temperatures or when the lubricant is highly viscous, even greater loads may be required. The weights of the components supported by the bearings, together with the external forces, generally exceed the requisite minimum load. If this is not the case, the needle roller thrust bearing must be preloaded (e.g. by springs).

Equivalent dynamic bearing load
For needle roller thrust bearings

$$P = F_a$$

Equivalent static bearing load
For needle roller thrust bearings

$$P_0 = F_a$$



Needle roller and cage thrust assembly Series AXK

Raceway washer Series LS

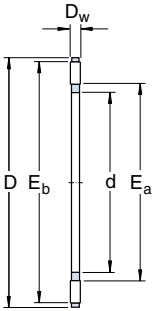
Thrust washer Series AS

Shaft washer Series WS 811

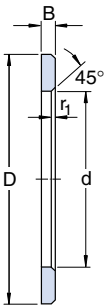
Housing washer Series GS 811

Principal dimensions Needle roller and cage thrust assembly					**Basic load ratings** dynamic	static	**Fatigue load limit**	**Speed ratings** Lubrication		**Mass** Needle roller and cage thrust assembly	**Designation** Needle roller and cage thrust assembly
d	D	D_w	E_a	E_b	C	C_0	P_u	grease	oil		
mm					N		N	r/min		g	–
4	14	2	5	13	4 150	8 300	865	5 600	7 500	0,7	**AXK 0414 TN**
5	15	2	6	14	4 500	9 500	1 000	5 000	6 700	0,8	**AXK 0515 TN**
6	19	2	7	18	6 300	16 000	1 750	4 500	6 000	1	**AXK 0619 TN**
8	21	2	9	20	7 200	20 000	2 200	4 300	5 600	2	**AXK 0821 TN**
10	24	2	12	23	8 500	26 000	2 850	3 600	4 800	3	**AXK 1024**
12	26	2	14	20	9 150	30 000	3 250	3 400	4 500	3	**AXK 1226**
15	28	2	17	27	10 400	37 500	4 150	3 200	4 300	4	**AXK 1528**
17	30	2	19	29	11 000	40 500	4 500	3 200	4 300	4	**AXK 1730**
20	35	2	22	34	12 000	47 500	5 300	2 800	3 800	5	**AXK 2035**
25	42	2	29	41	13 400	60 000	6 700	2 200	3 200	7	**AXK 2542**
30	47	2	34	46	15 000	72 000	8 000	2 000	3 000	8	**AXK 3047**
35	52	2	39	51	16 600	83 000	9 300	1 900	2 800	10	**AXK 3552**
40	60	3	45	58	25 000	114 000	13 700	1 700	2 400	16	**AXK 4060**
45	65	3	50	63	27 000	127 000	15 300	1 600	2 200	18	**AXK 4565**
50	70	3	55	68	28 500	143 000	17 000	1 600	2 200	20	**AXK 5070**
55	78	3	60	76	34 500	186 000	22 400	1 400	1 900	28	**AXK 5578**
60	85	3	65	83	37 500	232 000	28 500	1 300	1 800	33	**AXK 6085**
65	90	3	70	88	39 000	255 000	31 000	1 200	1 700	35	**AXK 6590**
70	95	4	74	93	49 000	255 000	30 500	1 200	1 700	60	**AXK 7095**
75	100	4	79	98	50 000	265 000	32 000	1 100	1 600	61	**AXK 75100**
80	105	4	84	103	51 000	280 000	33 500	1 000	1 500	63	**AXK 80105**

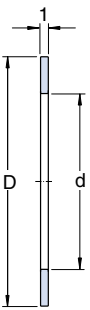
Dimensions Washers						**Masses** Washers		**Designations** Raceway washer	Thrust washer	Shaft washer	Housing washer
d	d_1	D	D_1	B	$r_{1,2}$ min	LS, WS, GS	AS				
mm						g		–			
4	–	14	–	–	–	–	1	**–**	**AS 0414**	**–**	**–**
5	–	15	–	–	–	–	1	**–**	**AS 0515**	**–**	**–**
6	–	19	–	2,75	0,3	4	2	**LS 0619**	**AS 0619**	**–**	**–**
8	–	21	–	2,75	0,3	4	2	**LS 0821**	**AS 0821**	**–**	**–**
10	–	24	–	2,75	0,3	7	3	**LS 1024**	**AS 1024**	**–**	**–**
12	–	26	–	2,75	0,3	8	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	9	4	**LS 1730**	**AS 1730**	**WS 81103**	**GS 81103**
20	35	35	21	2,75	0,3	13	5	**LS 2035**	**AS 2035**	**WS 81104**	**GS 81104**
25	42	42	26	3	0,6	19	7	**LS 2542**	**AS 2542**	**WS 81105**	**GS 81105**
30	47	47	32	3	0,6	22	8	**LS 3047**	**AS 3047**	**WS 81106**	**GS 81106**
35	52	52	37	3,5	0,6	29	9	**LS 3552**	**AS 3552**	**WS 81107**	**GS 81107**
40	60	60	42	3,5	0,6	40	12	**LS 4060**	**AS 4060**	**WS 81108**	**GS 81108**
45	65	65	47	4	0,6	50	13	**LS 4565**	**AS 4565**	**WS 81109**	**GS 81109**
50	70	70	52	4	0,6	55	14	**LS 5070**	**AS 5070**	**WS 81110**	**GS 81110**
55	78	78	57	5	0,6	88	18	**LS 5578**	**AS 5578**	**WS 81111**	**GS 81111**
60	85	85	62	4,75	1	97	22	**LS 6085**	**AS 6085**	**WS 81112**	**GS 81112**
65	90	90	67	5,25	1	115	24	**LS 6590**	**AS 6590**	**WS 81113**	**GS 81113**
70	95	95	72	5,25	1	125	25	**LS 7095**	**AS 7095**	**WS 81114**	**GS 81114**
75	100	100	77	5,75	1	140	27	**LS 75100**	**AS 75100**	**WS 81115**	**GS 81115**
80	105	105	82	5,75	1	150	28	**LS 80105**	**AS 80105**	**WS 81116**	**GS 81116**



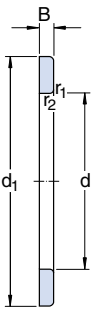
Needle roller and cage thrust assembly
Series AXK



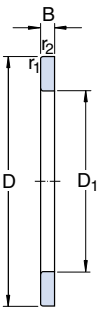
Raceway washer
Series LS



Thrust washer
Series AS



Shaft washer
Series WS 811



Housing washer
Series GS 811

Principal dimensions Needle roller and cage thrust assembly					**Basic load ratings** dynamic	static	**Fatigue load limit**	**Speed ratings** Lubrication		**Mass** Needle roller and cage thrust assembly	**Designation** Needle roller and cage thrust assembly
d	D	D_w	E_a	E_b	C	C_0	P_u	grease	oil		
mm					N		N	r/min		g	–
85	110	4	89	108	52 000	290 000	34 500	1 000	1 500	67	**AXK 85110**
90	120	4	94	118	65 500	405 000	48 000	900	1 300	86	**AXK 90120**
100	135	4	105	133	76 500	560 000	65 500	850	1 200	105	**AXK 100135**
110	145	4	115	143	81 500	620 000	71 000	800	1 100	120	**AXK 110145**
120	155	4	125	153	86 500	680 000	76 500	800	1 100	130	**AXK 120155**
130	170	5	136	167	112 000	830 000	93 000	700	950	205	**AXK 130170**
140	180	5	146	177	116 000	900 000	98 600	670	900	220	**AXK 140180**
150	190	5	156	187	120 000	950 000	102 000	630	850	230	**AXK 150190**
160	200	5	166	197	125 000	1 000 000	106 000	630	850	245	**AXK 160200**

Dimensions						Masses		Designations			
Washers						Washers		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		–			
85	110	110	87	5,75	1	160	29	**LS 85110**	**AS 85110**	**WS 81117**	**GS 81117**
90	120	120	92	6,5	1	235	39	**LS 90120**	**AS 90120**	**WS 81118**	**GS 81118**
100	135	135	102	7	1	350	50	**LS 100135**	**AS 100135**	**WS 81120**	**GS 81120**
110	145	145	112	7	1	385	55	**LS 110145**	**AS 110145**	**WS 81122**	**GS 81122**
120	145	155	122	7	1	415	59	**LS 120155**	**AS 120155**	**WS 81124**	**GS 81124**
130	170	170	132	9	1	665	65	**LS 130170**	**AS 130170**	**WS 81126**	**GS 81126**
140	178	180	142	9,5	1	750	79	**LS 140180**	**AS 140180**	**WS 81128**	**GS 81128**
150	188	190	152	9,5	1	795	84	**LS 150190**	**AS 150190**	**WS 81130**	**GS 81130**
160	198	200	162	9,5	1	840	89	**LS 160200**	**AS 160200**	**WS 81132**	**GS 81132**


SKF

Combined needle roller bearings

Needle roller/angular contact ball bearings ..... **page 130**
Needle roller/thrust ball bearings ..... **page 138**
Needle roller/cylindrical roller thrust bearings ..... **page 150**

Combined needle roller bearings consist of a radial needle roller bearing combined with a thrust bearing and are consequently able to take up both radial and axial loads. Combined needle roller bearings provide the means to produce locating bearing arrangements in a minimum of radial space. They are particularly useful where the axial loads are too heavy, speeds too high, or lubrication inadequate for simple thrust washers to be suitable, and other types of locating bearing take up too much room.

SKF combined needle roller bearings are available 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

Product tables ..... **page 134**

Needle roller/angular contact ball bearings combine a radial needle roller bearing with a radial angular contact ball bearing to produce a very low-section bearing which can operate at high speeds and which can carry heavy radial and light axial loads. The radial loads are accommodated exclusively by the needle roller bearings. The axial loads acting on the angular contact ball bearing should not exceed 25 % of the simultaneously acting radial load.

To ensure efficient lubrication, the needle roller bearing has an annular groove and lubrication hole in the outer ring.

Design

SKF needle roller/angular contact ball bearings of series NKIA 59 (➔ **fig** 1) can accommodate axial loads acting in one direction and can thus provide location for a shaft in one direction. They are of separable design, i.e. the inner ring can be mounted separately from the outer ring with rolling element and cage assemblies.

Bearings of series NKIB 59 (➔ **fig** 2) are able to locate a shaft in both directions with an axial play of 0,08 to 0,25 mm. For easy mounting, the inner ring is in two parts. When mounting the inner ring it is important to ensure that the two parts are mounted immediately adjacent to each other with zero axial clearance. The two parts are not interchangeable with the inner rings of other bearings.

For the support of short shafts, where alterations in length caused by thermal changes do not occur in operation, two bearings of series NKIA 59 can be used in a face-to-face or back-to-back arrangement (➔ **fig** 3).

Fig 1

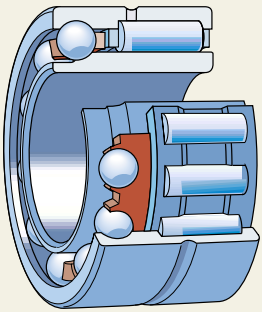
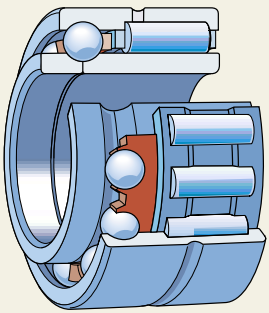


Fig 2



Dimensions
The boundary dimensions of bearings of series NKIA 59 are in accordance with Dimension Series 59 of ISO 15:1998. With the exception of the inner ring width, which is extended at one side, this also applies to bearings of series NKIB 59.

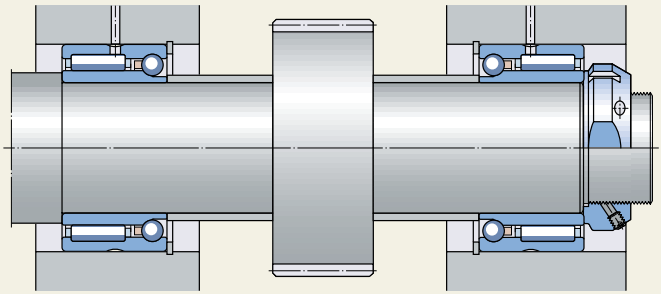
Tolerances
SKF needle roller/angular contact ball bearings are produced as standard with Normal tolerances to ISO 492:1994 (➔ **Table** 2, **page 17**). The only exceptions to this are the tolerances for the bore of the narrow part of the inner ring of series NKIB 59, which is larger, and for the width of the complete inner ring of series of series NKIB 59 bearings which is a uniform 0/–0,3 mm for all sizes.

Internal clearance
Needle roller/angular contact ball bearings are produced as standard with Normal internal clearance (➔ **Table** 6, **page 21**).

The clearance values conform to ISO 5753:1991. The bearings must be kept together as supplied, i.e. the outer rings with rolling element and cage assemblies, inner rings and inner ring parts are not interchangeable with those of other bearings.

Misalignment
The modified line contact between the needle rollers and raceways of needle roller/angular contact ball bearings enables minimum misalignments of the shaft relative to the housing to be accommodated without imposing heavy additional forces on the angular contact ball bearing.

Fig 3



Cages

The needle rollers of needle roller/angular contact ball bearings are guided in a steel (→ **fig** 4) or sheet steel cage (→ **fig** 5). The balls are retained in an injection moulded snap-type cage of glass fibre reinforced polyamide 6,6 (→ **fig** 6).

NB.
Needle roller/angular contact ball bearings with polyamide 6,6 cages can be used at temperatures up to +120 °C. With the exception of a few synthetic oils and greases with a synthetic base oil, and lubricants containing a high proportion of EP additives when used at high temperatures, the lubricants generally used for rolling bearings do not have a detrimental effect on cage properties.

For further information regarding the temperature resistance and use of cages, please refer to the section “Cages” (→ **page 22**).

Shaft and housing tolerances

For needle roller/angular contact ball bearings it is recommended that the shaft seating be machined to tolerance k5 and the housing bore seating to tolerance M6. Tighter fits than those achieved with these tolerances should be avoided as they would have a negative influence on bearing performance.

Fig 4

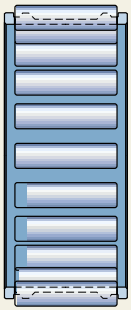


Fig 5

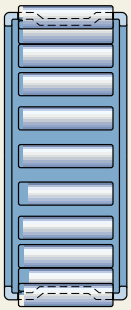


Fig 6



Minimum load
In order to guarantee satisfactory performance, needle roller/angular contact ball bearings, like all ball and roller bearings, must always be subjected to a given minimum load acting in both the radial and axial directions, particularly if they are to operate at high speeds or are subjected to high accelerations or rapid changes in the direction of load. Under such conditions the inertia forces of the rolling elements and cages, and the friction in the lubricant, can have a detrimental influence on the rolling conditions in the bearing arrangement and may cause damaging sliding movements to occur between the rolling elements and raceways.

The requisite minimum radial load to be applied to the radial needle roller bearing can be estimated using

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

The requisite minimum axial load for the angular contact ball bearing can be obtained from

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

where
F_{rm} = minimum radial load, N
F_{am} = minimum axial load, N
C = basic dynamic load rating, N
C_0 = basic static load rating, N
d_m = mean bearing diameter
$= 0{,}5\ (d + D)$, mm
n = rotational speed, r/min

When starting up at low temperatures or when the lubricant is highly viscous, even greater loads may be required. The weights of the components supported by the bearing, together with the external forces, generally exceed the requisite minimum loads. If this is not the case, the needle roller/angular contact ball bearing must be subjected to an additional radial and/or axial load.

Equivalent dynamic bearing load
For the radial needle roller bearing

$$P = F_r$$

and for the angular contact ball bearing

$$P = F_a$$

where F_a must not exceed $0{,}25\ F_r$.

Equivalent static bearing load
For the radial needle roller bearing

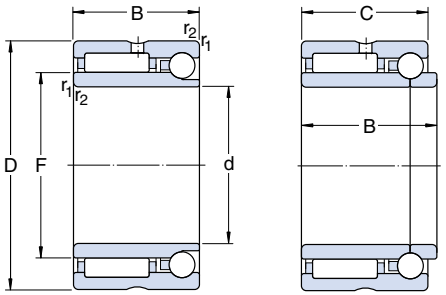
$$P_0 = F_r$$

and for the angular contact ball bearing

$$P_0 = F_a$$

where F_a must not exceed $0{,}25\ F_r$.

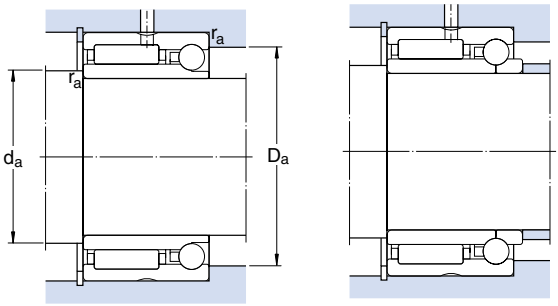
Load carrying capacity and life
It is necessary to calculate the lives of the radial needle roller bearing and the angular contact ball bearing separately for combined needle roller/angular contact ball bearings.



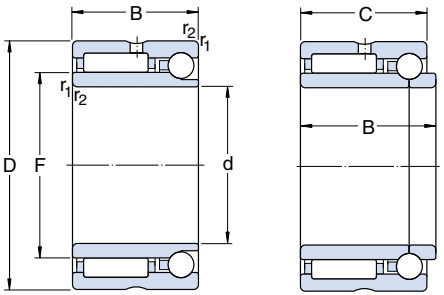
Single direction
Series NKIA

Double direction
Series NKIB

Principal dimensions				Basic load ratings				Fatigue load limits		Speed ratings		Mass	Designation
				radial		axial				Lubrication			
				dynamic	static	dynamic	static	radial	axial	grease	oil		
d	D	B	C	C	C_0	C	C_0	P_u	P_u				
mm				N				N		r/min		kg	–
12	24	16	–	8 250	10 000	2 070	1 920	1 140	83	15 000	22 000	0,040	**NKIA 5901**
	24	17,5	16	8 250	10 000	2 070	1 920	1 140	83	15 000	22 000	0,043	**NKIB 5901**
15	28	18	–	11 400	15 600	2 270	2 370	1 830	99	13 000	19 000	0,050	**NKIA 5902**
	28	20	18	11 400	15 600	2 270	2 370	1 830	99	13 000	19 000	0,052	**NKIB 5902**
17	30	18	–	11 700	17 000	2 240	2 740	1 960	116	12 000	18 000	0,056	**NKIA 5903**
	30	20	18	11 700	17 000	2 240	2 740	1 960	116	12 000	18 000	0,058	**NKIB 5903**
20	37	23	–	21 600	28 000	3 790	4 210	3 350	176	9 500	15 000	0,10	**NKIA 5904**
	37	25	23	21 600	28 000	3 790	4 210	3 350	176	9 500	15 000	0,11	**NKIB 5904**
22	39	23	–	23 300	32 000	4 140	4 930	3 900	205	9 000	14 000	0,12	**NKIA 59/22**
	39	25	23	23 300	32 000	4 140	4 930	3 900	205	9 000	14 000	0,12	**NKIB 59/22**
25	42	23	–	24 200	34 500	4 240	5 260	4 150	224	8 500	13 000	0,13	**NKIA 5905**
	42	25	23	24 200	34 500	4 240	5 260	4 150	224	8 500	13 000	0,13	**NKIB 5905**
30	47	23	–	25 500	39 000	4 540	6 320	4 650	268	7 500	11 000	0,15	**NKIA 5906**
	47	25	23	25 500	39 000	4 540	6 320	4 650	268	7 500	11 000	0,15	**NKIB 5906**
35	55	27	–	31 900	54 000	5 830	8 420	6 700	355	6 700	9 500	0,24	**NKIA 5907**
	55	30	27	31 900	54 000	5 830	8 420	6 700	355	6 700	9 500	0,25	**NKIB 5907**
40	62	30	–	42 900	71 000	7 170	10 900	8 800	467	5 600	8 000	0,32	**NKIA 5908**
	62	34	30	42 900	71 000	7 170	10 900	8 800	467	5 600	8 000	0,32	**NKIB 5908**
45	68	30	–	45 700	78 000	7 470	12 000	9 650	513	5 300	7 500	0,38	**NKIA 5909**
	68	34	30	45 700	78 000	7 470	12 000	9 650	513	5 300	7 500	0,38	**NKIB 5909**
50	72	30	–	47 300	85 000	7 740	13 700	10 600	579	5 000	7 000	0,38	**NKIA 5910**
	72	34	30	47 300	85 000	7 740	13 700	10 600	579	5 000	7 000	0,39	**NKIB 5910**
55	80	34	–	57 200	104 000	9 270	16 700	13 200	697	4 500	6 300	0,55	**NKIA 5911**
	80	38	34	57 200	104 000	9 270	16 700	13 200	697	4 500	6 300	0,56	**NKIB 5911**
60	85	34	–	59 400	114 000	9 580	18 000	14 300	770	4 300	6 000	0,59	**NKIA 5912**
	85	38	34	59 400	114 000	9 580	18 000	14 300	770	4 300	6 000	0,60	**NKIB 5912**



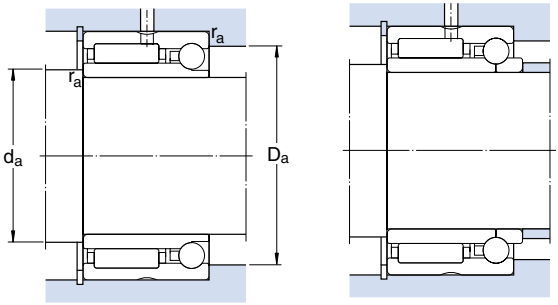
Dimensions			Abutment and fillet dimensions		
d	F	$r_{1,2}$ min	d_a min	D_a max	r_a max
mm			mm		
12	16	0,3	14	22	0,3
	16	0,3	14	22	0,3
15	20	0,3	17	26	0,3
	20	0,3	17	26	0,3
17	22	0,3	19	28	0,3
	22	0,3	19	28	0,3
20	25	0,3	22	35	0,3
	25	0,3	22	35	0,3
22	28	0,3	24	37	0,3
	28	0,3	24	37	0,3
25	30	0,3	27	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



Single direction
Series NKIA

Double direction
Series NKIB

Principal dimensions				**Basic load ratings** radial		axial		**Fatigue load limits**		**Speed ratings** Lubrication		**Mass**	**Designation**
				dynamic	static	dynamic	static	radial	axial	grease	oil		
d	D	B	C	C	C_0	C	C_0	P_u	P_u				
mm				N				N		r/min		kg	–
65	90	34	–	60 500	118 000	9 960	19 200	14 600	816	4 000	5 600	0,64	**NKIA 5913**
	90	38	34	60 500	118 000	9 960	19 200	14 600	816	4 000	5 600	0,64	**NKIB 5913**
70	100	40	–	84 200	163 000	13 200	25 000	20 800	1 050	3 600	5 000	0,98	**NKIA 5914**
	100	45	40	84 200	163 000	13 200	25 000	20 800	1 050	3 600	5 000	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

Product tables
Needle roller/thrust ball bearings, full complement ..... **page 146**
Needle roller/thrust ball bearings ..... **page 148**

Needle roller/thrust ball bearings are a combination of a radial needle roller bearing and a thrust ball bearing. In series NX the thrust ball bearing is a full complement bearing, i.e. without cage (➔ **fig** 1). In series NKX, the thrust ball bearing is of the "normal" caged design (➔ **fig** 2).

All SKF needle roller/thrust ball bearings are supplied without 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** 3). Appropriate inner rings are shown in the product tables.

Fig 3

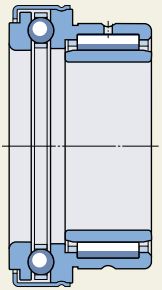


Fig 1

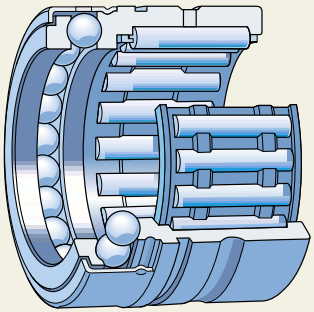
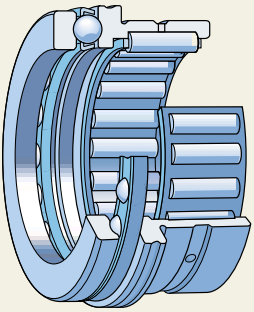


Fig 2



Needle roller/full complement thrust ball bearings, series NX

SKF needle roller/full complement thrust ball bearings of series NX are suitable for the accommodation of moderate radial loads and lighter, single direction axial loads. Their special characteristic is their extremely low sectional height which allows shaft centrelines to be positioned close together, as for example, in multi-spindle drillling machines.

For axial support, the bearings may be mounted against a shoulder in the housing bore, or against a retaining ring mounted in the housing bore. The use of a snap ring inserted in the snap ring groove in the outer ring provides a particularly economic and axially space-saving arrangement (→ **fig** 4). The appropriate snap rings are shown in the product table but are not supplied by SKF.

NX needle roller/full complement thrust ball bearings have a pressed steel cover which extends over the shaft washer of the thrust bearing and is firmly attached to the radial needle roller bearing and are therefore non-separable. Bearings of series NX have lubrication holes in the cover (→ **fig** 5) and are intended for oil lubrication. For grease lubrication, bearings of series NX .. Z (→ **fig** 6) should be used. These have no lubrication holes in the cover. The cover forms a gap-type seal with the shaft washer.

Fig 4

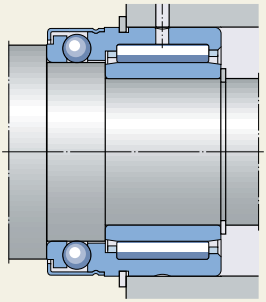


Fig 5

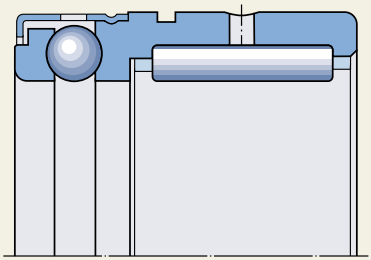
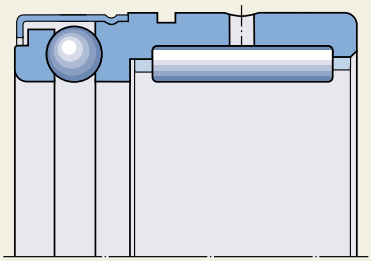


Fig 6



Needle roller/thrust ball bearings, series NKX

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

NKX needle roller/thrust ball bearings (➔ **fig** 7) are of separable design. The needle roller and cage assembly with outer ring and integral housing washer, the ball and cage thrust assembly and the shaft washer can all be mounted individually. The non-separable bearings of series NKX .. Z have a cover attached to the housing washer (integral with the needle roller bearing outer ring) which extends over the shaft washer and holds the bearing together (➔ **fig** 8). The cover forms a gap-type seal with the shaft washer. Bearings of this series are particularly suitable for grease lubrication as the cover retains the grease in the bearing and prevents it from being expelled by the ball and cage assembly. The separable bearings of series NKX should be lubricated with oil where possible as oil makes it easier to ensure an adequate supply of lubricant to the bearing.

Fig 7

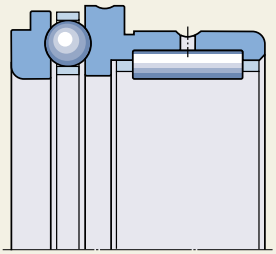
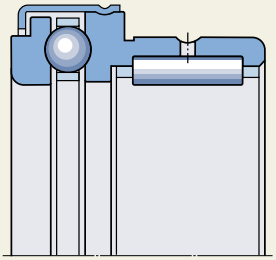


Fig 8



Dimensions

The boundary dimensions of needle roller/thrust ball bearings of series NKX conform to DIN 5429, Part 1, 1987. The dimensions of series NX bearings are not standardised but have been generally accepted by industry.

Tolerances

SKF needle roller/thrust ball bearings are supplied having the tolerances shown in **Table** 1. The radial runout corresponds to the values given in ISO 492:1994 and the axial runout to ISO 199:1997 for normal tolerances (➔ **Tables** 2 and 5, **pages 17** and **20**).

The values for the deviations from the nominal dimensions of the ISO tolerance grades quoted in **Table** 1 are given in **Table** 2.

Internal clearance

It is recommended that the shaft seating be machined to tolerance k5 and the housing bore seating to tolerance K6. For stiff bearing arrangements, housing bore tolerance M6 has been found appropriate. If separate inner rings are used, a shaft seating tolerance of k5 is again suitable.

These tolerances will give a suitable internal clearance for the bearing which is somewhat smaller than the Normal radial internal clearance specified in ISO 5753:1991.

Misalignment

Needle roller/thrust ball bearings cannot accept any angular misalignment of the shaft with respect to the housing, nor any errors of angle between the support surfaces on the shaft or in the housing.

Table 1

Needle roller/thrust ball bearing tolerances

Dimension		Tolerance
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

Table 2

ISO tolerances

Nominal dimension 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

Fig 9

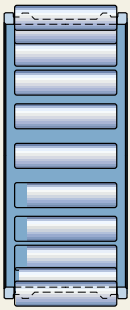


Fig 10

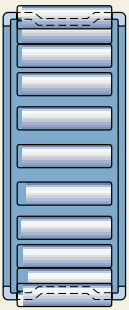
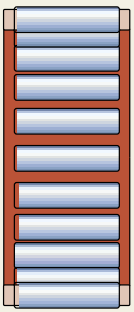


Fig 11



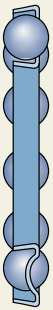
Cages

The needle rollers of SKF needle roller/thrust ball bearings are guided in a cage of steel (➔ **fig** 9), or sheet steel (➔ **fig** 10), except in bearings identified by the designation suffix TN where a glass fibre reinforced polyamide 6,6 cage is used (➔ **fig** 11). The cage which retains the balls of the thrust ball bearing is made of pressed steel (➔ **fig** 12).

NB.
Needle roller/thrust ball bearings with polyamide 6,6 cages can be used at temperatures up to +120 °C. With the exception of a few synthetic oils and greases with a synthetic base oil, and lubricants containing a high proportion of EP additives when used at high temperatures, the lubricants generally used for rolling bearings do not have a detrimental effect on cage properties.

For further information regarding the temperature resistance and use of cages, please refer to the section “Cages” (➔ **page 22**).

Fig 12



Design of associated components
The diameter of the support surface for the integral housing washer of needle roller/thrust ball bearings must always be at least 0,5 mm larger than the dimension D_1 or D_2 (➔ **fig** 13) in order to ensure a clearance fit.

Raceways on the shaft
If the load carrying capacity of the radial needle roller bearing is to be fully exploited then the hardness and surface finish of the raceway machined on the shaft should be the same as those of inner ring raceways. Details of suitable materials, hardness and surface finish will be found in the section "Raceways on shafts and in housings" (➔ **page 28**).

Application recommendations
SKF needle roller/thrust ball bearings can axially locate a shaft in one direction. Short shafts, where there is no risk of changes in length occurring in practice as a result of thermal changes, may be supported in two bearings arranged either face-to-face or back-to-back (➔ **fig** 14). In such cases it is recommended that the thrust ball bearings be elastically preloaded, e.g. by cup springs. This elastic preload serves to ensure proper and quiet performance of the thrust ball bearing without any slip when it is unloaded.

Fig 13

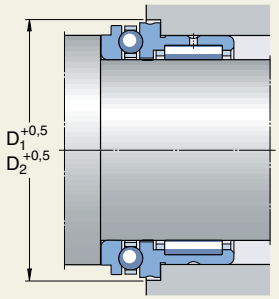
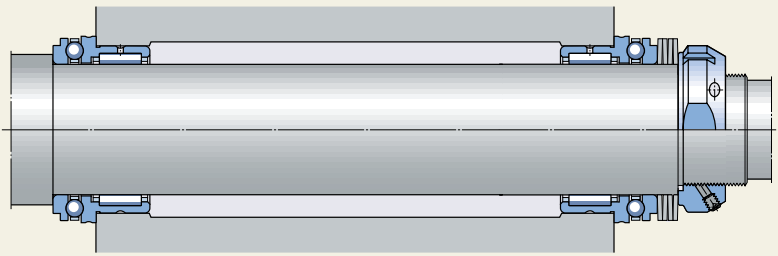


Fig 14



Minimum load
In order to guarantee satisfactory operation, needle roller/thrust ball bearings, like all ball and roller bearings, must always be subjected to a given minimum load acting in both the radial and axial directions, particularly if they are to operate at high speeds or are subjected to high accelerations or rapid changes in the direction of load. Under such conditions the inertia forces of the rolling elements and cages, and the friction in the lubricant, can have a detrimental influence on the rolling conditions in the bearing arrangement and may cause damaging sliding movements to occur between the rolling elements and raceways.

The requisite minimum radial load to be applied to the radial needle roller bearing can be estimated using

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

The requisite minimum axial load for the thrust ball bearing can be obtained from

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

where
F_{rm} = minimum radial load, N
F_{am} = minimum axial load, N
A = minimum load factor, see product tables
C = basic dynamic load rating, N
n = rotational speed, r/min

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

Equivalent dynamic bearing load
For the radial needle roller bearing

$$P = F_r$$

and for the thrust ball bearing

$$P = F_a$$

Equivalent static bearing load
For the radial needle roller bearing

$$P_0 = F_r$$

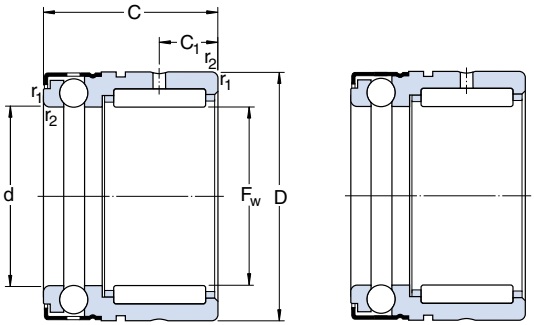
and for the thrust ball bearing

$$P_0 = F_a$$

Load carrying capacity and life
It is necessary to calculate the life of the radial needle roller bearing and of the thrust ball bearing separately for needle roller/thrust ball bearings.

Needle roller/thrust ball bearings, full complement

F_w **7 – 35** mm

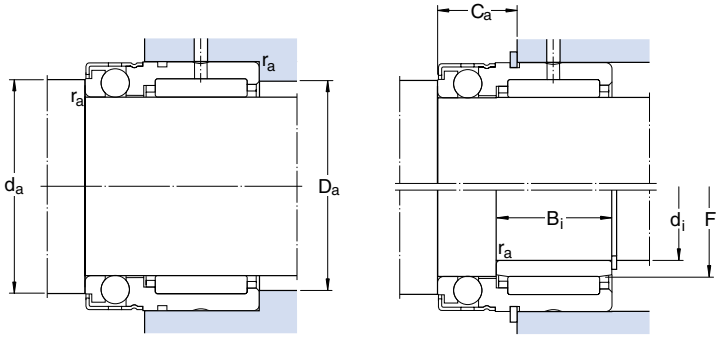


For oil lubrication
Series NX

For grease lubrication
Series NX .. Z

Principal dimensions			Basic load ratings radial		axial		Fatigue load limits		Min. load factor	Speed ratings Lubrication		Mass	Designation
			dynamic	static	dynamic	static	radial	axial		grease	oil		
F_w	D	C	C	C_0	C	C_0	P_u	P_u	A				
mm			N				N		–	r/min		kg	–
7	14	18	2 810	2 750	3 450	5 000	290	186	0,13	–	10 000	0,014	**NX 7 TN**[1]
	14	18	2 810	2 750	3 450	5 000	290	186	0,13	7 500	–	0,014	**NX 7 ZTN**[1]
10	19	18	4 680	4 150	5 070	8 500	475	310	0,38	–	8 500	0,025	**NX 10**
	19	18	4 680	4 150	5 070	8 500	475	310	0,38	6 300	–	0,025	**NX 10 Z**
12	21	18	5 500	5 400	5 270	9 650	610	355	0,48	–	8 000	0,028	**NX 12**
	21	18	5 500	5 400	5 270	9 650	610	355	0,48	6 000	–	0,028	**NX 12 Z**
15	24	28	11 200	14 000	6 180	12 200	1 660	450	0,77	–	7 500	0,048	**NX 15**
	24	28	11 200	14 000	6 180	12 200	1 660	450	0,77	5 600	–	0,048	**NX 15 Z**
17	26	28	12 300	16 600	6 370	13 400	1 960	500	0,93	–	7 000	0,053	**NX 17**
	26	28	12 300	16 600	6 370	13 400	1 960	500	0,93	5 300	–	0,053	**NX 17 Z**
20	30	28	13 400	19 600	7 800	17 300	2 280	640	1,6	–	6 300	0,068	**NX 20**
	30	28	13 400	19 600	7 800	17 300	2 280	640	1,6	4 800	–	0,068	**NX 20 Z**
25	37	30	15 400	25 000	12 400	28 500	2 900	1 060	4,2	–	5 600	0,12	**NX 25**
	37	30	15 400	25 000	12 400	28 500	2 900	1 060	4,2	4 300	–	0,12	**NX 25 Z**
30	42	30	22 900	39 000	12 700	32 500	4 800	1 200	5,5	–	5 300	0,13	**NX 30**
	42	30	22 900	39 000	12 700	32 500	4 800	1 200	5,5	4 000	–	0,13	**NX 30 Z**
35	47	30	24 600	45 000	13 500	38 000	5 600	1 400	7,5	–	5 000	0,16	**NX 35**
	47	30	24 600	45 000	13 500	38 000	5 600	1 400	7,5	3 800	–	0,16	**NX 35 Z**

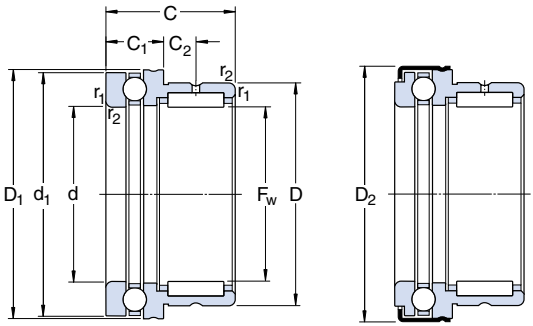
[1] Bearing with closure ring insert



Dimensions				Abutment and fillet dimensions				Appropriate inner ring[1] Dimensions			Designation	Appropriate retaining ring[2] 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	SW 19
	4,7	10	0,3	14,5	17	10	0,3	6	10	10	IR 6×10×10	SW 19
12	4,7	12	0,3	16,5	19	10	0,3	8	12	10	IR 8×12×10	SW 21
	4,7	12	0,3	16,5	19	10	0,3	8	12	10	IR 8×12×10	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	SW 37
	8	25	0,3	31,5	35	14,2	0,3	20	25	16	IR 20×25×16	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 25×30×20	SW 42
35	10	35	0,3	40,5	45	14,2	0,3	30	35	20	IR 30×35×20	SW 47
	10	35	0,3	40,5	45	14,2	0,3	30	35	20	IR 30×35×20	SW 47

[1] Details of appropriate inner rings will be found in the section “Inner rings” (➔ **page 204**)
[2] To DIN 471; not supplied by SKF

Needle roller/thrust ball bearings
F_w **10 – 70** mm

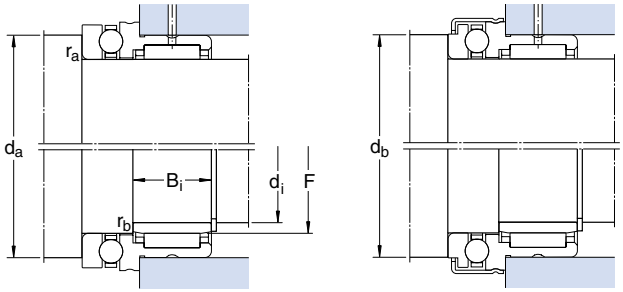


Without cover
Series NKX

With cover
Series NKX .. Z

Principal dimensions			Basic load ratings radial dynamic		axial dynamic		Fatigue load limits radial	axial	Min. load factor	Speed ratings Lubrication grease	oil	Mass	Designation
F_w	D	C	C	C_0	C	C_0	P_u	P_u	A				
mm			N				N		–	r/min		kg	–
10	19	23	5 940	8 000	9 950	15 300	900	560	1,2	7 000	9 500	0,034	**NKX 10 TN**[1]
	19	23	5 940	8 000	9 950	15 300	900	560	1,2	7 000	9 500	0,036	**NKX 10 ZTN**[1]
12	21	23	6 160	8 650	10 400	16 600	980	620	1,4	6 700	9 000	0,038	**NKX 12**
	21	23	6 160	8 650	10 400	16 600	980	620	1,4	6 700	9 000	0,040	**NKX 12 Z**
15	24	23	11 200	14 000	10 600	18 300	1 660	670	1,7	6 300	8 500	0,044	**NKX 15**
	24	23	11 200	14 000	10 600	18 300	1 660	670	1,7	6 300	8 500	0,047	**NKX 15 Z**
17	26	25	12 300	16 600	10 800	19 600	1 960	735	2,0	6 300	8 500	0,053	**NKX 17**
	26	25	12 300	16 600	10 800	19 600	1 960	735	2,0	6 300	8 500	0,055	**NKX 17 Z**
20	30	30	16 800	26 000	14 300	27 000	3 050	1 000	3,8	5 600	7 500	0,083	**NKX 20**
	30	30	16 800	26 000	14 300	27 000	3 050	1 000	3,8	5 600	7 500	0,090	**NKX 20 Z**
25	37	30	19 000	32 500	19 500	40 500	4 000	1 500	8,5	4 800	6 300	0,13	**NKX 25**
	37	30	19 000	32 500	19 500	40 500	4 000	1 500	8,5	4 800	6 300	0,13	**NKX 25 Z**
30	42	30	22 900	39 000	20 300	45 500	4 800	1 700	10	4 500	6 000	0,14	**NKX 30**
	42	30	22 900	39 000	20 300	45 500	4 800	1 700	10	4 500	6 000	0,15	**NKX 30 Z**
35	47	30	24 600	45 000	21 200	51 000	5 600	1 900	13	4 300	5 600	0,16	**NKX 35**
	47	30	24 600	45 000	21 200	51 000	5 600	1 900	13	4 300	5 600	0,17	**NKX 35 Z**
40	52	32	26 400	51 000	27 000	68 000	6 300	2 550	24	3 800	5 000	0,20	**NKX 40**
	52	32	26 400	51 000	27 000	68 000	6 300	2 550	24	3 800	5 000	0,21	**NKX 40 Z**
45	58	32	28 100	57 000	28 100	75 000	7 100	2 800	29	3 400	4 500	0,25	**NKX 45**
	58	32	28 100	57 000	28 100	75 000	7 100	2 800	29	3 400	4 500	0,27	**NKX 45 Z**
50	62	35	38 000	80 000	28 600	81 500	9 650	3 050	34	3 200	4 300	0,28	**NKX 50**
	62	35	38 000	80 000	28 600	81 500	9 650	3 050	34	3 200	4 300	0,30	**NKX 50 Z**
60	72	40	41 800	96 500	41 600	122 000	11 800	4 550	77	2 600	3 600	0,36	**NKX 60**
	72	40	41 800	96 500	41 600	122 000	11 800	4 550	77	2 600	3 600	0,38	**NKX 60 Z**
70	85	40	44 600	98 000	43 600	137 000	12 200	5 100	97	2 400	3 400	0,50	**NKX 70**
	85	40	44 600	98 000	43 600	137 000	12 200	5 100	97	2 400	3 400	0,52	**NKX 70 Z**

[1] Bearing with closure ring insert



Dimensions							Abutment and fillet dimensions								Appropriate inner ring[1] 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

[1] Details of appropriate inner rings will be found in the section “Inner rings” (➔ **page 204**)

Needle roller/cylindrical roller thrust bearings

Product tables ..... **page 156**

Needle roller/cylindrical roller thrust bearings are combinations of a radial needle roller bearing and a cylindrical roller thrust bearing of series 811. In addition to radial loads they are able to accommodate very heavy axial loads acting in one direction and can therefore locate a shaft in one direction.

Designs

SKF needle roller/cylindrical roller thrust bearings of series NKXR (➔ **fig** 1) are separable. The outer ring with integral housing washer and with the radial needle roller and cage assembly, the cylindrical roller and cage thrust assembly, and the shaft washer can all be mounted individually.

The series NKXR .. Z bearings are non-separable (➔ **fig** 2). A cover is attached to the housing washer (integral with the needle roller bearing outer ring) and extends over the shaft washer, thus holding the bearing together. The cover forms a gap type seal with the shaft washer.

Bearings with cover are particularly suitable for grease lubrication as the cover retains the grease in the bearing, preventing it from being ejected by the cylindrical roller and cage thrust assembly.

The separable bearings of series NKXR, on the other hand, should preferably be lubricated with oil as an adequate oil supply is relatively easy to arrange.

The needle roller/cylindrical roller thrust bearings are supplied without inner ring. For applications where the shaft cannot be hardened and ground, inner rings should be used (➔ **fig** 3). Appropriate inner rings are shown in the product table.

Fig 1

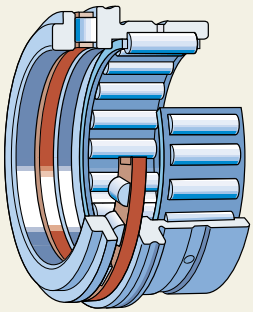
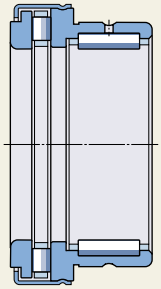


Fig 2



Dimensions

The boundary dimensions of the single direction needle roller/cylindrical roller thrust bearings conform to DIN 5429, Part 1, 1987.

Tolerances

The tolerances to which needle roller/cylindrical roller thrust bearings are produced as standard are given in **Table** 1. The radial runout corresponds to the values given in ISO 492:1994 and the axial runout to ISO 199:1997, for normal tolerances (➔ **Tables** 2 and 5, **pages 17** and **20**).

The values for the deviations from the nominal dimension of the ISO tolerance grades given in **Table** 1 will be found in **Table** 2.

Fig 3

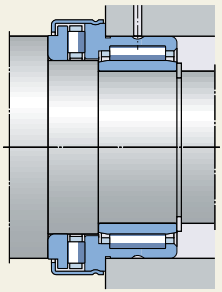


Table 1

Needle roller/cylindrical roller thrust bearing tolerances

Dimension		Tolerance
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

Table 2

ISO tolerances

Nominal dimension 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

Internal clearance

It is recommended that the shaft seating for needle roller/cylindrical roller thrust bearings be machined to tolerance k5 and the housing bore seating to tolerance K6. A housing bore tolerance of M6 has been found appropriate for stiff bearing arrangements. The shaft seating tolerance k5 is also appropriate when inner rings are used.

These recommended tolerances will provide a radial internal clearance for the bearing which is somewhat smaller than Normal according to ISO 5753:1991.

Misalignment

Needle roller/cylindrical roller thrust bearings cannot accept any angular misalignment of the shaft with respect to the housing, nor any errors of angle between the support surfaces on the shaft or in the housing.

Cages

The needle rollers of SKF needle roller/cylindrical roller thrust bearings are guided in a cage of steel (→ **fig** 4), or sheet steel (→ **fig** 5). The cage which retains the cylindrical rollers of the cylindrical roller thrust bearing is an injection moulded glass fibre reinforced polyamide 6,6 cage (→ **fig** 6).

NB.
Needle roller/cylindrical roller thrust bearings with polyamide 6,6 cages can be used at temperatures up to +120 °C. With the exception of a few synthetic oils and greases with a synthetic base oil, and lubricants containing a high proportion of EP additives when used at high temperatures, the lubricants generally used for rolling bearings do not have a detrimental effect on cage properties.

For further information regarding the temperature resistance and use of cages, please refer to the section “Cages” (→ **page 22**).

Fig 4

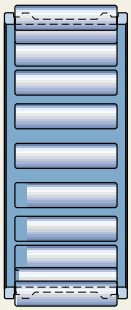


Fig 5

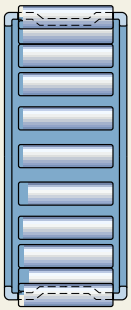


Fig 6

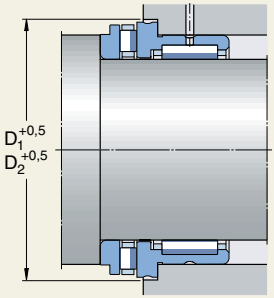


Design of associated components
The diameter of the support surface for the integral housing washer of needle roller/cylindrical roller thrust bearings must always be at least 0,5 mm larger than the dimension D_1 or D_2 (➔ **fig** 7) in order to ensure a clearance fit.

Raceways on the shaft
If the load carrying capacity of the radial needle roller bearing is to be fully exploited then the hardness and surface finish of the raceway machined on the shaft should be the same as those of inner ring raceways. Details of suitable materials, hardness and surface finish will be found in the section "Raceways on shafts and in housings" (➔ **page 28**).

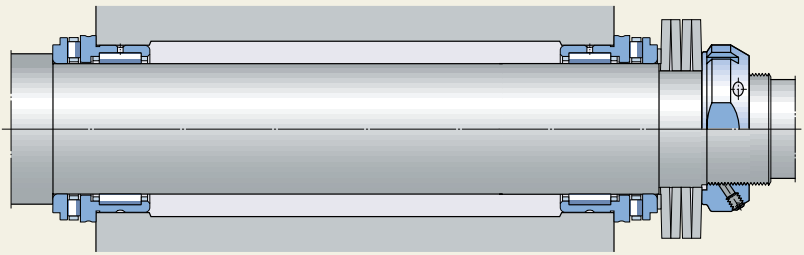
Application recommendations
SKF needle roller/cylindrical roller thrust bearings can axially locate a shaft in one direction. Short shafts, where there is no risk of changes in length occurring in practice as a result of thermal changes, may be supported in two bearings arranged either face-to-face or back-to-back (➔ **fig** 8). In such cases it is recommended that the cylindrical roller thrust bearings be elastically preloaded, e.g. by cup springs. This elastic preload serves to ensure proper and quiet performance of the thrust bearing without any slip when it is unloaded.

Fig 7



3

Fig 8



Minimum load
In order to guarantee satisfactory operation, needle roller/cylindrical roller thrust bearings, like all ball and roller bearings, must always be subjected to a given minimum load acting in both the radial and axial directions, particularly if they are to operate at high speeds or are subjected to high accelerations or rapid changes in the direction of load. Under such conditions the inertia forces of the rollers and cages, and the friction in the lubricant, can have a detrimental influence on the rolling conditions in the bearing arrangement and may cause damaging sliding movements to occur between the rollers and raceways.

The requisite minimum radial load to be applied to the radial needle roller bearing can be estimated using

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

The requisite minimum axial load for the cylindrical roller thrust bearing can be obtained from

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

where
F_{rm} = minimum radial load, N
F_{am} = minimum axial load, N
A = minimum load factor, see product tables
C = basic dynamic load rating, N
n = rotational speed, r/min

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

Equivalent dynamic bearing load
For the radial needle roller bearing

$$P = F_r$$

and for the cylindrical roller thrust bearing

$$P = F_a$$

Equivalent static bearing load
For the radial needle roller bearing

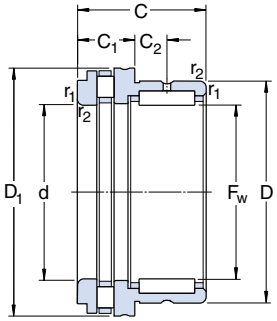
$$P_0 = F_r$$

and for the cylindrical roller thrust bearing

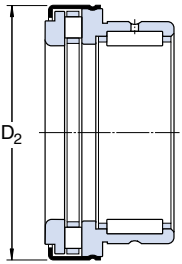
$$P_0 = F_a$$

Load carrying capacity and life
It is necessary to calculate the life of the radial needle roller bearing and of the cylindrical roller thrust bearing separately for needle roller/cylindrical roller thrust bearings.

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

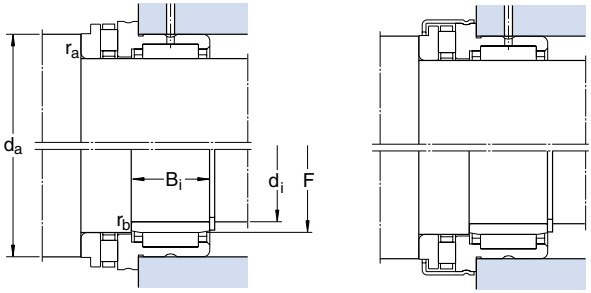


Without cover
Series NKXR



With cover
Series NKXR .. Z

Principal dimensions			Basic load ratings radial dynamic		axial dynamic		Fatigue load limits radial	axial	Min. load factor	Speed ratings Lubrication grease	oil	Mass	Designation
F_w	D	C	C	C_0	C	C_0	P_u	P_u	A				
mm			N				N		–	r/min		kg	–
15	24	23	11 200	14 000	11 200	27 000	1 660	2 450	0,058	3 200	4 300	0,042	**NKXR 15**
	24	23	11 200	14 000	11 200	27 000	1 660	2 450	0,058	3 200	4 300	0,045	**NKXR 15 Z**
17	26	25	12 300	16 600	12 200	31 500	1 960	2 850	0,079	3 200	4 300	0,050	**NKXR 17**
	26	25	12 300	16 600	12 200	31 500	1 960	2 850	0,079	3 200	4 300	0,053	**NKXR 17 Z**
20	30	30	16 800	26 000	18 600	48 000	3 050	4 650	0,18	2 800	3 800	0,080	**NKXR 20**
	30	30	16 800	26 000	18 600	48 000	3 050	4 650	0,18	2 800	3 800	0,084	**NKXR 20 Z**
25	37	30	19 000	32 500	25 000	69 500	4 000	6 800	0,39	2 200	3 200	0,12	**NKXR 25**
	37	30	19 000	32 500	25 000	69 500	4 000	6 800	0,39	2 200	3 200	0,13	**NKXR 25 Z**
30	42	30	22 900	39 000	27 000	78 000	4 800	7 650	0,49	2 000	3 000	0,14	**NKXR 30**
	42	30	22 900	39 000	27 000	78 000	4 800	7 650	0,49	2 000	3 000	0,14	**NKXR 30 Z**
35	47	30	24 600	45 000	29 000	93 000	5 600	9 150	0,69	1 900	2 800	0,16	**NKXR 35**
	47	30	24 600	45 000	29 000	93 000	5 600	9 150	0,69	1 900	2 800	0,17	**NKXR 35 Z**
40	52	32	26 400	51 000	43 000	137 000	6 300	13 700	1,5	1 700	2 400	0,20	**NKXR 40**
	52	32	26 400	51 000	43 000	137 000	6 300	13 700	1,5	1 700	2 400	0,21	**NKXR 40 Z**
45	58	32	28 100	57 000	45 000	153 000	7 100	15 300	1,9	1 600	2 200	0,24	**NKXR 45**
	58	32	28 100	57 000	45 000	153 000	7 100	15 300	1,9	1 600	2 200	0,26	**NKXR 45 Z**
50	62	35	38 000	80 000	47 500	166 000	9 650	16 600	2,2	1 600	2 200	0,27	**NKXR 50**
	62	35	38 000	80 000	47 500	166 000	9 650	16 600	2,2	1 600	2 200	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] Details of appropriate inner rings will be found in the section “Inner rings” (➔ **page 204**)


SKF

Support rollers

Product tables
Support rollers without axial guidance, without inner ring ..... **page 168**
Support rollers without axial guidance, with inner ring ..... **page 170**
Support rollers with axial guidance ..... **page 172**

SKF support rollers are basically needle or cylindrical roller bearings with a thick-walled outer ring. The outside surface of the outer ring is crowned which serves to prevent edge stresses if the roller runs in a tilted or inclined position. They are ready-to-mount units which are filled with grease and are suitable for all types of cam drives, tracks and conveyor systems etc.

SKF support rollers are available

- without axial guidance (➔ **fig** 1) and
- with axial guidance (➔ **fig** 2).

The support rollers without axial guidance are supplied in a non-sealed (open) design and a sealed version. Five series of support roller with axial guidance are available. Four of the series have the same dimensions, differing only in their internal design.

Fig 1

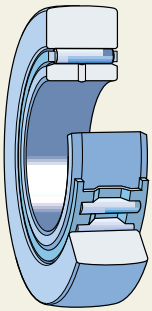
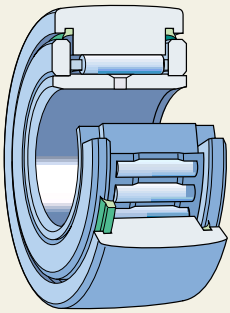


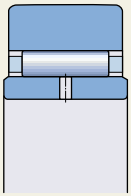
Fig 2



Support rollers without axial guidance
SKF support rollers without axial guidance are designed for applications where the associated components can be designed to provide axial guidance. The support rollers without inner ring are intended for arrangements where the pin or shaft can be hardened and ground.

The inner rings of support rollers with inner ring are slightly extended to ensure the necessary axial play.

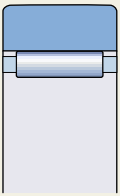
Fig 3



Support rollers of the (R)STO design

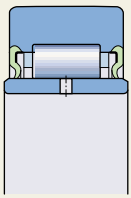
Support rollers of the (R)STO design are particularly simple in design. The support rollers with inner ring (➔ **fig** 3) have the series designation STO, while those without inner ring (➔ **fig** 4) are identified by the prefix R; the series designation being RSTO. All components of these support rollers can be mounted separately.

Fig 4



Support rollers of the STO design can be used for applications where grease lubrication is employed as well as for oil-lubricated applications. Where oil is to be used, it is recommended that the grease contained in the roller on delivery is washed out first.

Fig 5

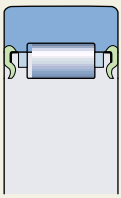


Support rollers of the (R)NA 22.2RS design

Support rollers of the (R)NA 22.2RS design are fitted with rubbing seals of oil and wear-resistant nitrile rubber (NBR) which are suitable for operating temperatures between –30 and +120 °C. They are designed for applications where particulate contamination is light to moderate and there is a possibility of moisture penetrating.

The needle roller and cage assembly of the rollers is axially guided between two integral flanges in the outer ring and forms a non-separable unit with the outer ring. The inner ring of the NA 22.2RS bearings (➔ **fig** 5) can be mounted separately. When the outer ring assembly and inner ring are joined, care must be taken not to damage the lips of the seals. Support rollers of series RNA 22.2RS (➔ **fig** 6) are without inner ring.

Fig 6



Support rollers with axial guidance
SKF support rollers with axial guidance are non-separable units and are especially suitable for applications where lateral (thrust) surfaces are not available. Thrust forces resulting from alignment errors or inclined running are taken up by side washers or flange rings; the side washers are either loose or pressed on to the inner ring. When designing the associated components and mounting the support rollers it is important to ensure that the flange rings and inner rings with pressed-on washers are located without axial play. If larger thrust forces are expected, it is recommended that axial support is also provided for the washers which are pressed on to the inner ring (➔ "Design of associated components", **page167**).

Support rollers of the NATR design

Support rollers of the NATR design (➔ **fig 7**) incorporate cage-guided needle rollers and permit relatively high speed operation. The outer ring is guided by the side washers which are pressed on to the inner ring; the washers form gap-type seals with the outer ring.

The outer ring is particularly thick-walled and intended for heavy loads and also shock loads.

Support rollers of the NATV design

Support rollers of the NATV design (➔ **fig 8**) are similar to those of the NATR design except that they have a full complement of rollers. The absence of a cage enables the maximum number of needle rollers to be incorporated so that these support rollers can carry even heavier loads than those of the NATR design. However, because of the kinematic conditions they are not able to operate at such high speeds. They also require more frequent relubrication.

Fig 7

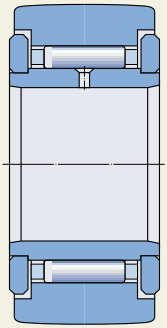
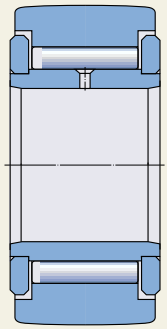


Fig 8



Sealed NATR and NATV support rollers – PP and PPA designs

Support rollers of the NATR and NATV series can also be supplied with rubbing seals. Sealed support rollers are intended for universal application, but particularly for use where difficult conditions pertain which call for efficient sealing of the bearing position.

Support rollers of the PP design (➔ **fig** 9) have seals of nitrile rubber (NBR) or polyurethane at both sides and are suitable for operating temperatures from –30 to +100 °C. They are being gradually replaced by the more robust PPA design.

The seals of support rollers of the PPA design are replaced by sliding thrust washers of polyamide 6,6 (➔ **fig** 10). These reduce the sliding friction between the outer ring and side washer and allow a reduction in the running temperature of the roller; this is favourable with regard to the service life of the grease. The sliding washer has the form of a cup spring with a sealing lip and acts as an axial seal which reliably retains grease in the roller. In the radial direction a narrow labyrinth is formed with the outer ring which excludes coarse contaminants. The permissible operating temperature range for the sealed support rollers is –30 to +100 °C.

All support rollers of the PPA design have an enhanced runner profile (outside diameter of outer ring). The new design allows a more favourable distribution of stress than the crowned profile of the earlier design, even when running in a tilted position. This leads to higher stiffness and less wear between the runner surface and its counterface.

Fig 9

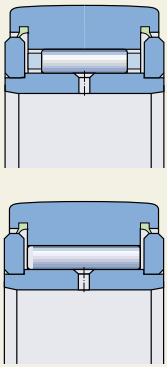
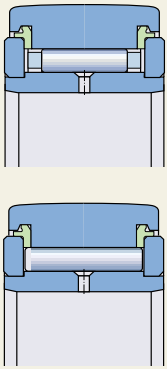


Fig 10



Support rollers of the NUTR design

Support rollers of the NUTR design (➔ **fig** 11) are based on double row full complement cylindrical roller bearings. The outer ring has two integral flanges, which axially guide the roller complement. Two loose flange rings provide axial guidance for the outer ring via the roller complement. Sheet metal angle rings pressed into the outer ring and extending over the flange rings serve to hold the components together and form efficient labyrinth seals.

NUTR support rollers can accommodate heavy radial loads. As the outer ring is guided via the rollers large axial forces can also be taken up. The support rollers can also be operated at relatively high speeds. Being of the full complement type, these support rollers require more frequent relubrication.

If heavy shock loads can be expected, the rollers with reinforced outer ring should be used. These are identified by four or five-figure numbers in the designation.

NUTR support rollers also have an enhanced runner profile (outside diameter of outer ring) identified by suffix A in the designation. The new design allows a more favourable distribution of stress than the crowned profile of the earlier design, even when running in a tilted position. This leads to higher stiffness and less wear between the runner surface and its counterface.

Fig 11

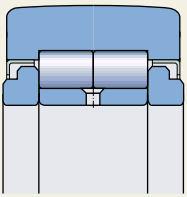
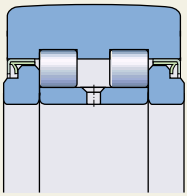


Fig 12



Support rollers of the PWTR.2RS design

Support rollers of series PWTR.2RS (➔ **fig** 12) are sealed and therefore particularly suitable for operation under arduous conditions. The outer ring has three integral flanges, which axially guide the two rows of rollers (full complement) separately. Two loose flange rings provide axial guidance for the outer ring via the roller complements. Sheet metal angle rings pressed into the outer ring and extending over the flange rings serve to hold the components together. Rubbing seals, of oil and wear-resistant nitrile rubber (NBR), are integral with the angle rings and seal against the flange rings.

The special features of these support rollers include the rubbing seals, the three in-tegral outer ring flanges and the large space between the two rows of rollers. The separate guidance of the two rows of rollers means that friction in the support roller is low and thus also heat generation. The PWTR support rollers are very suitable for the accommodation of axial forces, which can occur if the roller runs in an inclined position.

The large space between the two rows of rollers allows a large quantity of grease to be incorporated and the rubbing seals provide efficient protection against contamination. It is therefore possible to operate support rollers of series PWTR.2RS for much longer periods between maintenance intervals than was previously possible, even under contaminated conditions. The permissible operating temperature range is –30 to +120 °C.

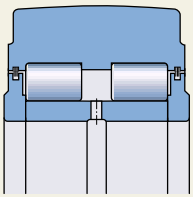
Support rollers of the NNTR.2ZL design

Support rollers of series NNTR.2ZL (➔ **fig** 13) are large and can carry very heavy loads. The outer ring has three integral flanges which axially guide the two rows of rollers (full complement) separately. Two loose flange rings provide axial guidance for the outer ring via the roller complements. The NNTR support rollers incorporate lamellar seals at both sides. These are inserted in grooves in the shoulders of the flange rings and in the outer ring shoulders and hold all the bearing components together.

The separate guidance of the two roller rows reduces friction and thus heat generation. The NNTR support rollers are thus suitable for the accommodation of heavy axial loads, even when they act constantly, which can occur, for example, if the roller runs in an inclined position. The double row full complement of rollers imparts high radial load carrying capacity.

The large free space between the two rows of rollers means that a large quantity of grease can be filled into the rollers. The lamellar seals provide efficient protection. Extended maintenance intervals are therefore possible, even under difficult conditions.

Fig 13



Dimensions

The dimensions of the support rollers of series (R)NA 22.2RS conform to ISO 15:1998. The dimensions of the support rollers of series NATR, NATV, NUTR and PWTR, where standardised, conform to ISO 6278-1980 and ANSI/AFBMA Standard 16.1-1988 as well as ANSI/AFBMA Standard 18.1-1976.

Tolerances

SKF support rollers are produced to Normal tolerances in accordance with ISO 492:1994 (➔ **Table** 2, **page 17**) with the following exceptions:

- the tolerance for the outside diameter surface of the roller with its modified profile is 0/–0,050 mm;
- the width B of support rollers of series NATR, NATV and NUTR corresponds to h12;
- the circularity of the inner rings of support rollers of series NATR and NATV.

The diameter under the roller sets, F_w, of support rollers without inner ring, series RSTO and RNA 22.2RS lies within the limits of F6.

The limits for tolerances h12 and F6 will be found in **Table** 1.

Table 1

ISO tolerances

Nominal dimension over	incl.	**h12** Deviations high	low	**F6** Deviations high	low
mm		µm		µm	
3	**6**	0	-120	+18	+10
6	**10**	0	-150	+22	+13
10	**18**	0	-180	+27	+16
18	**30**	0	-210	+33	+20
30	**50**	0	-250	+41	+25
50	**80**	0	-300	+49	+30
80	**120**	0	-350	+58	+36

Internal clearance

SKF support rollers of series STO and NA 22.2RS are produced as standard with Normal radial internal clearance as specified in ISO 5753:1991. The other support rollers have a clearance in the C2 range corresponding to class 2 according to ISO 5753:1991 (➔ **Table** 6, **page 21**).

Load carrying capacity

In contrast to normal roller bearings, where the outer ring is supported over its entire outside diameter surface in the bore of a housing, the outer ring of a support roller only has a small area of contact with the surface against which is runs, e.g. a rail or cam. The deformation of the outer ring caused by this limited contact alters the force distribution in the bearing and thus has an influence on life and load carrying capacity. The basic load ratings given in the table section take this into account.

The ability to carry dynamic loads depends on the requisite life, but it is important with reference to the strength and deformation of the outer ring that the value of the maximum dynamic radial load F_r quoted in the table section is not exceeded.

The permissible static load for a support roller is determined by the smaller of the values of F_{0r} and C_0. If requirements regarding 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

The cages of support rollers of series STO, NA 22.2RS and NATR are made of steel (→ **fig** 14), except for those rollers of the STO design which are identified by the designation suffix TN. These rollers have a cage of glass fibre reinforced polyamide 6,6 (→ **fig** 15).

NB.
The support rollers with polyamide cages can be operated at temperatures up to +120 °C and cage properties are not affected by the lubricant used.

For further information regarding the temperature resistance and use of cages, please refer to the section “Cages” (→ **page 22**).

Fig 14

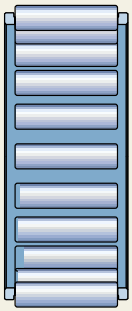
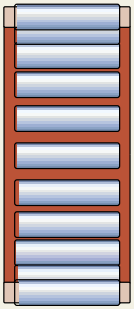


Fig 15



Lubrication

All support rollers are supplied as standard filled with a high-quality lithium complex base grease is based on mineral oil and of consistency 2 to the NLGI Scale. The grease is based on mineral oil and has good rust inhibiting properties. It has an operating temperature range of –25 to +150 °C.

SKF support rollers require little maintenance. To exploit their full service life, they must, however, be relubricated, preferably while the first 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. Generally, where loads are light, speeds relatively low and the surroundings clean, support rollers can operate for long periods without relubrication. If, however, the environment is contaminated and damp, frequent relubrication is required as it is also if speeds are high or the operating temperature above +70 °C.

For relubrication it is recommended that SKF grease be used – grease LGMT 2 or preferably LGWA 2. This is a lithium complex grease with a mineral oil base and has good rust inhibiting properties.

Design of associated components
The support surfaces for the outer rings of the support rollers without axial guidance should be at least fine turned and be free of burrs and clean. Unhardened surfaces should extend to at least half the outer ring side face (➔ **fig** 16) whilst hardened surfaces may be smaller. Support rollers without inner ring, series RSTO and RNA 22.2RS, must have a clearance of 0,2 mm to the support surfaces. Details regarding the design of raceways on pins will be found in the section “Raceways on shafts and in housings” (➔ **page 28**).

For support rollers with axial guidance which are to be heavily loaded, it is recommended that complete support is provided for the side washers and that the support surface is dimensioned according to the diameter d_1 (➔ **fig** 17).

Tolerances for pins
With very few exceptions, support rollers 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 tolerance g6. The appropriate tolerance for pins for support rollers without inner ring is k5.

Mounting instructions
Care should be taken to see that the lubrication hole in the inner ring is in the unloaded zone of the support roller after mounting.

It should be noted that the inner ring and the two loose flange rings of support rollers of series NUTR, PWTR.2RS and NNTR.2ZL should be firmly clamped together when mounted.

Fig 16

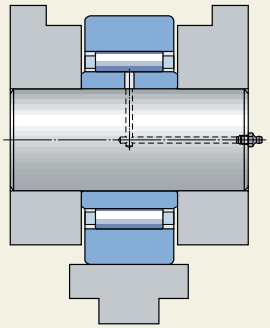
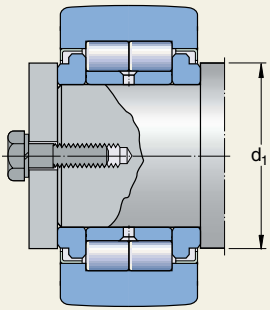
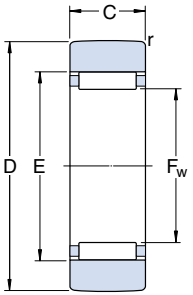


Fig 17

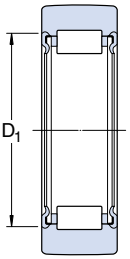


3

Support rollers without axial guidance, without inner ring
D **16 – 90** mm



Series RSTO



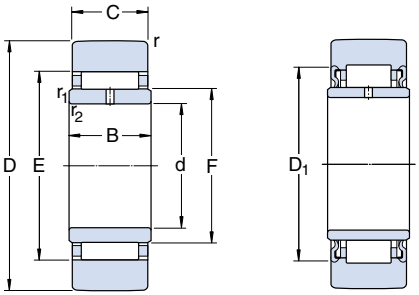
Series RNA 22.2RS

Dimensions						Speed rating	Mass	Designation
D	C	D_1	F_w	E	r min			
mm						r/min	kg	–
16	7,8	–	7	10	0,3	16 000	0,0085	**RSTO 5 TN**
19	9,8	–	10	13	0,3	10 000	0,013	**RSTO 6 TN**
	11,8	16	10	–	0,3	9 000	0,018	**RNA 22/6.2RS**
24	9,8	–	12	15	0,3	8 000	0,021	**RSTO 8 TN**
	11,8	18	12	–	0,3	7 000	0,029	**RNA 22/8.2RS**
30	11,8	–	14	20	0,3	5 500	0,042	**RSTO 10**
	13,8	20	14	–	0,6	5 500	0,052	**RNA 2200.2RS**
32	11,8	–	16	22	0,3	4 500	0,049	**RSTO 12**
	13,8	22	16	–	0,6	4 700	0,057	**RNA 2201.2RS**
35	11,8	–	20	26	0,3	3 300	0,050	**RSTO 15**
	13,8	26	20	–	0,6	3 400	0,060	**RNA 2202.2RS**
40	15,8	–	22	29	0,3	2 800	0,088	**RSTO 17**
	15,8	28	22	–	1	3 000	0,094	**RNA 2203.2RS**
47	15,8	–	25	32	0,3	2 400	0,13	**RSTO 20**
	17,8	33	25	–	1	2 300	0,15	**RNA 2204.2RS**
52	15,8	–	30	37	0,3	1 800	0,15	**RSTO 25**
	17,8	38	30	–	1	1 800	0,18	**RNA 2205.2RS**
62	19,8	–	38	46	0,6	1 300	0,26	**RSTO 30**
	19,8	43	35	–	1	1 400	0,28	**RNA 2206.2RS**
72	19,8	–	42	50	0,6	1 100	0,38	**RSTO 35**
	22,7	50	42	–	1,1	1 100	0,43	**RNA 2207.2RS**
80	19,8	–	50	58	1	850	0,42	**RSTO 40**
	22,7	57	48	–	1,1	850	0,53	**RNA 2208.2RS**
85	19,8	–	55	63	1	750	0,45	**RSTO 45**
	22,7	62	52	–	1,1	800	0,55	**RNA 2209.2RS**
90	19,8	–	60	68	1	650	0,48	**RSTO 50**
	22,7	68	58	–	1,1	650	0,56	**RNA 2210.2RS**

Designation	Basic load ratings dynamic C	static C_0	Fatigue load limit P_u	Maximum radial forces dynamic P_u	static F_r F_{0r}
–	N		N	N	
RSTO 5 TN	2 510	2 500	270	3 550	5 000
RSTO 6 TN	3 740	4 500	500	4 250	6 100
RNA 22/6.2RS	3 520	3 000	340	1 930	2 750
RSTO 8 TN	4 130	5 400	600	7 500	10 800
RNA 22/8.2RS	4 460	4 400	500	5 000	7 100
RSTO 10	8 250	8 800	1 040	8 500	12 200
RNA 2200.2RS	6 440	7 200	850	12 000	17 000
RSTO 12	8 800	9 800	1 180	8 300	12 000
RNA 2201.2RS	6 930	8 150	965	11 600	16 600
RSTO 15	9 130	10 600	1 270	7 100	10 000
RNA 2202.2RS	7 210	9 000	1 040	9 650	13 700
RSTO 17	14 200	17 600	2 080	12 000	17 300
RNA 2203.2RS	9 350	12 900	1 530	16 000	22 800
RSTO 20	16 100	21 200	2 500	18 600	26 500
RNA 2204.2RS	15 400	17 300	2 120	17 600	25 500
RSTO 25	16 500	22 800	2 700	18 000	26 000
RNA 2205.2RS	16 100	19 000	2 320	17 300	24 500
RSTO 30	22 900	34 500	4 250	23 600	33 500
RNA 2206.2RS	17 600	24 500	3 000	28 500	40 500
RSTO 35	24 600	39 000	4 800	36 000	51 000
RNA 2207.2RS	22 000	34 000	4 300	39 000	56 000
RSTO 40	23 800	39 000	4 750	34 500	49 000
RNA 2208.2RS	27 000	39 000	4 900	37 500	53 000
RSTO 45	25 100	43 000	5 300	34 500	50 000
RNA 2209.2RS	27 500	41 500	5 200	39 000	56 000
RSTO 50	26 000	45 500	5 700	34 500	50 000
RNA 2210.2RS	27 000	41 500	5 200	36 500	52 000

Support rollers without axial guidance, with inner ring

D **19 – 90** mm



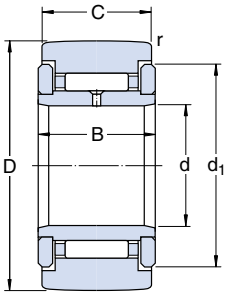
Series STO

Series NA 22.2RS

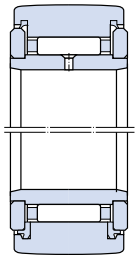
Dimensions									Speed rating	Mass	Designation
D	C	B	d	D_1	F	E	r min	$r_{1,2}$ min			
mm									r/min	kg	–
19	9,8	10	6	–	10	13	0,3	0,3	10 000	0,017	**STO 6 TN**
	11,8	12	6	16	10	–	0,3	0,3	9 000	0,022	**NA 22/6.2RS**
24	9,8	10	8	–	12	15	0,3	0,3	8 000	0,026	**STO 8 TN**
	11,8	12	8	18	12	–	0,3	0,3	7 000	0,034	**NA 22/8.2RS**
30	11,8	12	10	–	14	20	0,3	0,3	5 500	0,049	**STO 10**
	13,8	14	10	20	14	–	0,6	0,3	5 500	0,060	**NA 2200.2RS**
32	11,8	12	12	–	16	22	0,3	0,3	4 500	0,057	**STO 12**
	13,8	14	12	22	16	–	0,6	0,3	4 700	0,067	**NA 2201.2RS**
35	11,8	12	15	–	20	26	0,3	0,3	3 300	0,063	**STO 15**
	13,8	14	15	26	20	–	0,6	0,3	3 400	0,075	**NA 2202.2RS**
40	15,8	16	17	–	22	29	0,3	0,3	2 800	0,11	**STO 17**
	15,8	16	17	28	22	–	1	0,3	3 000	0,11	**NA 2203.2RS**
47	15,8	16	20	–	25	32	0,3	0,3	2 400	0,15	**STO 20**
	17,8	18	20	33	25	–	1	0,3	2 300	0,18	**NA 2204.2RS**
52	15,8	16	25	–	30	37	0,3	0,3	1 800	0,18	**STO 25**
	17,8	18	25	38	30	–	1	0,3	1 800	0,21	**NA 2205.2RS**
62	19,8	20	30	–	38	46	0,6	0,6	1 300	0,31	**STO 30**
	19,8	20	30	43	35	–	1	0,3	1 400	0,32	**NA 2206.2RS**
72	19,8	20	35	–	42	50	0,6	0,6	1 100	0,44	**STO 35**
	22,7	23	35	50	42	–	1,1	0,6	1 100	0,51	**NA 2207.2RS**
80	19,8	20	40	–	50	58	1	1	850	0,53	**STO 40**
	22,7	23	40	57	48	–	1,1	0,6	850	0,63	**NA 2208.2RS**
85	19,8	20	45	–	55	63	1	1	750	0,58	**STO 45**
	22,7	23	45	62	52	–	1,1	0,6	800	0,66	**NA 2209.2RS**
90	19,8	20	50	–	60	68	1	1	650	0,62	**STO 50**
	22,7	23	50	68	58	–	1,1	0,6	650	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}
–	N		N	N	
STO 6 TN	3 740	4 500	500	4 250	6 100
NA 22/6.2RS	3 520	3 000	340	1 930	2 750
STO 8 TN	4 130	5 400	600	7 500	10 800
NA 22/8.2RS	4 460	4 400	500	5 000	7 100
STO 10	8 250	8 800	1 040	8 500	12 200
NA 2200.2RS	6 440	7 200	850	12 000	17 000
STO 12	8 800	9 800	1 180	8 300	12 000
NA 2201.2RS	6 930	8 150	965	11 600	16 600
STO 15	9 130	10 600	1 270	7 100	10 000
NA 2202.2RS	7 210	9 000	1 040	9 650	13 700
STO 17	14 200	17 600	2 080	12 000	17 300
NA 2203.2RS	9 350	12 900	1 530	16 000	22 800
STO 20	16 100	21 200	2 500	18 600	26 500
NA 2204.2RS	15 400	17 300	2 120	17 600	25 500
STO 25	16 500	22 800	2 700	18 000	26 000
NA 2205.2RS	16 100	19 000	2 320	17 300	24 500
STO 30	22 900	34 500	4 250	23 600	33 500
NA 2206.2RS	17 600	24 500	3 000	28 500	40 500
STO 35	25 500	40 500	5 000	36 000	51 000
NA 2207.2RS	22 000	34 000	4 300	39 000	56 000
STO 40	23 800	39 000	4 750	34 500	49 000
NA 2208.2RS	27 000	39 000	4 900	37 500	53 000
STO 45	25 100	43 000	5 300	34 500	50 000
NA 2209.2RS	27 500	41 500	5 200	39 000	56 000
STO 50	26 000	45 500	5 700	34 500	50 000
NA 2210.2RS	27 000	41 500	5 200	36 500	52 000

Support rollers with axial guidance
D **16 – 32** mm



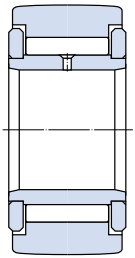
Series NATR



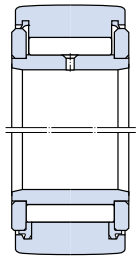
Series NATR .. PP
Series NATR .. PPA

Dimensions						Speed rating	Mass	Designation[1]
D	d	C	B	d_1	r min			
mm						r/min	kg	–
16	5	11	12	12,5	0,15	14 000	0,014	**NATR 5**
	5	11	12	12,5	0,15	14 000	0,014	NATR 5 PP
	5	11	12	12,5	0,15	14 000	0,014	**NATR 5 PPA**
	5	11	12	12,5	0,15	3 800	0,015	**NATV 5**
	5	11	12	12,5	0,15	3 800	0,015	NATV 5 PP
	5	11	12	12,5	0,15	3 800	0,015	**NATV 5 PPA**
19	6	11	12	15	0,15	11 000	0,020	**NATR 6**
	6	11	12	15	0,15	11 000	0,020	NATR 6 PP
	6	11	12	15	0,15	11 000	0,019	**NATR 6 PPA**
	6	11	12	15	0,15	3 100	0,021	**NATV 6**
	6	11	12	15	0,15	3 100	0,021	NATV 6 PP
	6	11	12	15	0,15	3 100	0,021	**NATV 6 PPA**
24	8	14	15	19	0,3	7 500	0,041	**NATR 8**
	8	14	15	19	0,3	7 500	0,041	NATR 8 PP
	8	14	15	19	0,3	7 500	0,038	**NATR 8 PPA**
	8	14	15	19	0,3	2 500	0,042	**NATV 8**
	8	14	15	19	0,3	2 500	0,042	NATV 8 PP
	8	14	15	19	0,3	2 500	0,041	**NATV 8 PPA**
30	10	14	15	23	0,6	5 500	0,064	**NATR 10**
	10	14	15	23	0,6	5 500	0,064	NATR 10 PP
	10	14	15	23	0,6	5 500	0,061	**NATR 10 PPA**
	10	14	15	23	0,6	2 100	0,065	**NATV 10**
	10	14	15	23	0,6	2 100	0,065	NATV 10 PP
	10	14	15	23	0,6	2 100	0,064	**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 PP
	12	14	15	25	0,6	4 500	0,066	**NATR 12 PPA**
	12	14	15	25	0,6	1 800	0,072	**NATV 12**
	12	14	15	25	0,6	1 800	0,072	NATV 12 PP
	12	14	15	25	0,6	1 800	0,069	**NATV 12 PPA**

[1] All support rollers of the PP design (designation printed in grey) will be gradually replaced by the PPA design



Series NATV

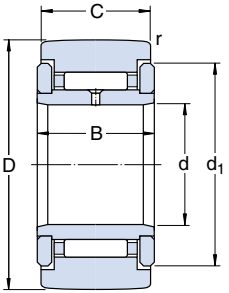


Series NATV .. PP
Series NATV .. PPA

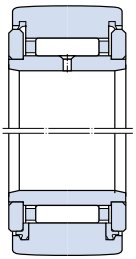
Designation[1]	Basic load ratings dynamic C	static C_0	Fatigue load limits P_u	Maximum radial forces dynamic F_r	static F_{0r}
–	N		N	N	
NATR 5	3 140	3 200	345	2 900	4 150
NATR 5 PP	3 140	3 200	345	2 900	4 150
NATR 5 PPA	3 140	3 200	345	2 900	4 150
NATV 5	4 730	6 550	720	4 050	5 700
NATV 5 PP	4 730	6 550	720	4 050	5 700
NATV 5 PPA	4 730	6 550	720	4 050	5 700
NATR 6	3 470	3 800	415	3 800	5 500
NATR 6 PP	3 470	3 800	415	3 800	5 500
NATR 6 PPA	3 470	3 800	415	3 800	5 500
NATV 6	5 280	8 000	880	5 100	7 350
NATV 6 PP	5 280	8 000	880	5 100	7 350
NATV 6 PPA	5 280	8 000	880	5 100	7 350
NATR 8	5 280	6 100	695	5 200	7 350
NATR 8 PP	5 280	6 100	695	5 200	7 350
NATR 8 PPA	5 280	6 100	695	5 200	7 350
NATV 8	7 480	11 400	1 320	7 350	10 400
NATV 8 PP	7 480	11 400	1 320	7 350	10 400
NATV 8 PPA	7 480	11 400	1 320	7 350	10 400
NATR 10	6 440	8 000	880	7 800	11 200
NATR 10 PP	6 440	8 000	880	7 800	11 200
NATR 10 PPA	6 440	8 000	880	7 800	11 200
NATV 10	8 970	14 600	1 660	11 000	15 600
NATV 10 PP	8 970	14 600	1 660	11 000	15 600
NATV 10 PPA	8 970	14 600	1 660	11 000	15 600
NATR 12	6 600	8 500	950	7 650	10 800
NATR 12 PP	6 600	8 500	950	7 650	10 800
NATR 12 PPA	6 600	8 500	950	7 650	10 800
NATV 12	9 350	15 300	1 760	10 600	15 000
NATV 12 PP	9 350	15 300	1 760	10 600	15 000
NATV 12 PPA	9 350	15 300	1 760	10 600	15 000

[1] All support rollers of the PP design (designation printed in grey) will be gradually replaced by the PPA design

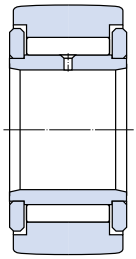
Support rollers with axial guidance
D **35 – 47** mm



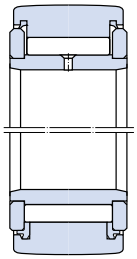
Series NATR



Series NATR .. PP
Series NATR .. PPA



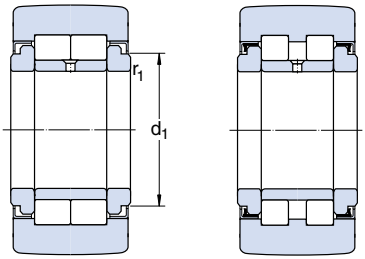
Series NATV



Series NATV .. PP
Series NATV .. PPA

Dimensions							Speed rating	Mass	Designation[1]
D	d	C	B	d_1	r min	r_1 min			
mm							r/min	kg	–
35	15	18	19	27,6	0,6	–	3 600	0,10	**NATR 15**
	15	18	19	27,6	0,6	–	3 600	0,10	NATR 15 PP
	15	18	19	27,6	0,6	–	3 600	0,095	**NATR 15 PPA**
	15	18	19	27,6	0,6	–	1 600	0,11	**NATV 15**
	15	18	19	27,6	0,6	–	1 600	0,11	NATV 15 PP
	15	18	19	27,6	0,6	–	1 600	0,10	**NATV 15 PPA**
	15	18	19	20	0,6	0.3	6 500	0,10	**NUTR 15 A**
	15	18	19	20	0,6	0,3	6 000	0,10	**PWTR 15.2RS**
40	17	20	21	31,5	1	–	2 900	0,14	**NATR 17**
	17	20	21	31,5	1	–	2 900	0,14	NATR 17 PP
	17	20	21	31,5	1	–	2 900	0,14	**NATR 17 PPA**
	17	20	21	31,5	1	–	1 400	0,15	**NATV 17**
	17	20	21	31,5	1	–	1 400	0,15	NATV 17 PP
	17	20	21	31,5	1	–	1 400	0,15	**NATV 17 PPA**
	17	20	21	22	1	0,5	5 500	0,15	**NUTR 17 A**
	17	20	21	22	1	0,5	5 000	0,15	**PWTR 17.2RS**
42	15	18	19	20	0,6	0,3	6 500	0,16	**NUTR 1542 A**
	15	18	19	20	0,6	0,3	6 000	0,16	**PWTR 1542.2RS**
47	17	20	21	22	1	0,5	5 500	0,22	**NUTR 1747 A**
	17	20	21	22	1	0,5	5 000	0,22	**PWTR 1747.2RS**
	20	24	25	36,5	1	–	2 400	0,25	**NATR 20**
	20	24	25	36,5	1	–	2 400	0,25	NATR 20 PP
	20	24	25	36,5	1	–	2 400	0,24	**NATR 20 PPA**
	20	24	25	36,5	1	–	1 300	0,25	**NATV 20**
	20	24	25	36,5	1	–	1 300	0,25	NATV 20 PP
	20	24	25	36,5	1	–	1 300	0,25	**NATV 20 PPA**
	20	24	25	27	1	0,5	4 200	0,25	**NUTR 20 A**
	20	24	25	27	1	0,5	3 800	0,25	**PWTR 20.2RS**

[1] All support rollers of the PP design (designation printed in grey) will be gradually replaced by the PPA design

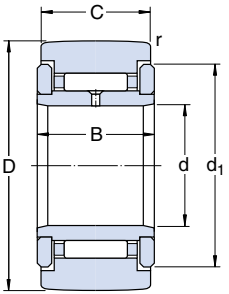


Series NUTR .. A Series PWTR.2RS

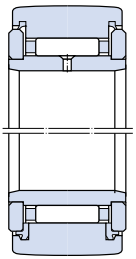
Designation[1]	Basic load ratings dynamic C	static C_0	Fatigue load limits P_u	Maximum radial forces dynamic F_r	static F_{0r}
–	N		N	N	
NATR 15	9 520	13 700	1 560	11 400	16 300
NATR 15 PP	9 520	13 700	1 560	11 400	16 300
NATR 15 PPA	9 520	13 700	1 560	11 400	16 300
NATV 15	12 300	23 200	2 700	14 600	20 800
NATV 15 PP	12 300	23 200	2 700	14 600	20 800
NATV 15 PPA	12 300	23 200	2 700	14 600	20 800
NUTR 15 A	16 800	17 600	2 000	8 650	12 200
PWTR 15.2RS	11 900	11 400	1 200	8 650	12 500
NATR 17	10 500	14 600	1 730	12 500	18 000
NATR 17 PP	10 500	14 600	1 730	12 500	18 000
NATR 17 PPA	10 500	14 600	1 730	12 500	18 000
NATV 17	14 200	26 500	3 100	17 000	24 500
NATV 17 PP	14 200	26 500	3 100	17 000	24 500
NATV 17 PPA	14 200	26 500	3 100	17 000	24 500
NUTR 17 A	19 000	22 000	2 500	14 000	20 000
PWTR 17.2RS	13 800	14 300	1 500	13 700	19 600
NUTR 1542 A	20 100	23 200	2 650	21 600	31 000
PWTR 1542.2RS	14 200	15 000	1 600	22 000	31 500
NUTR 1747 A	22 000	27 000	3 050	30 000	43 000
PWTR 1747.2RS	15 700	17 600	1 860	30 000	42 500
NATR 20	14 700	24 500	2 900	23 600	33 500
NATR 20 PP	14 700	24 500	2 900	23 600	33 500
NATR 20 PPA	14 700	24 500	2 900	23 600	33 500
NATV 20	19 400	41 500	5 000	30 500	43 000
NATV 20 PP	19 400	41 500	5 000	30 500	43 000
NATV 20 PPA	19 400	41 500	5 000	30 500	43 000
NUTR 20 A	28 600	33 500	3 900	17 600	25 000
PWTR 20.2RS	22 900	24 500	2 800	18 300	26 000

[1] All support rollers of the PP design (designation printed in grey) will be gradually replaced by the PPA design

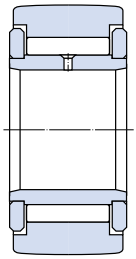
Support rollers with axial guidance
D **52 – 80** mm



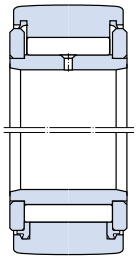
Series NATR



Series NATR .. PP
Series NATR .. PPA



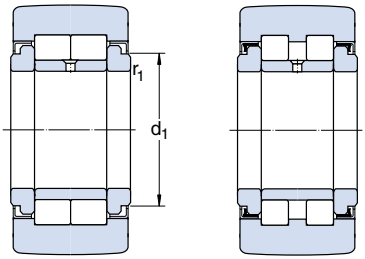
Series NATV



Series NATV .. PP
Series NATV .. PPA

Dimensions							Speed rating	Mass	Designation[1]
D	d	C	B	d_1	r min	r_1 min			
mm							r/min	kg	–
52	20	24	25	27	1	0,5	4 200	0,32	**NUTR 2052 A**
	20	24	25	27	1	0,5	3 800	0,32	**PWTR 2052.2RS**
	25	24	25	41,5	1	–	1 800	0,28	**NATR 25**
	25	24	25	41,5	1	–	1 800	0,28	**NATR 25 PP**
	25	24	25	41,5	1	–	1 800	0,27	**NATR 25 PPA**
	25	24	25	41,5	1	–	1 000	0,29	**NATV 25**
	25	24	25	41,5	1	–	1 000	0,29	**NATV 25 PP**
	25	24	25	41,5	1	–	1 000	0,28	**NATV 25 PPA**
	25	24	25	31	1	0,5	4 200	0,28	**NUTR 25 A**
	25	24	25	31	1	0,5	2 800	0,28	**PWTR 25.2RS**
62	25	24	25	31	1	0,5	3 400	0,45	**NUTR 2562 A**
	25	24	25	31	1	0,5	2 800	0,45	**PWTR 2562.2RS**
	30	28	29	51	1	–	1 300	0,47	**NATR 30**
	30	28	29	51	1	–	1 300	0,47	**NATR 30 PP**
	30	28	29	51	1	–	1 300	0,44	**NATR 30 PPA**
	30	28	29	51	1	–	850	0,48	**NATV 30**
	30	28	29	51	1	–	850	0,48	**NATV 30 PP**
	30	28	29	51	1	–	850	0,47	**NATV 30 PPA**
	30	28	29	38	1	0,5	2 600	0,47	**NUTR 30 A**
	30	28	29	38	1	0,5	2 200	0,47	**PWTR 30.2RS**
72	30	28	29	38	1	0,5	2 600	0,70	**NUTR 3072 A**
	30	28	29	38	1	0,5	2 200	0,70	**PWTR 3072.2RS**
	35	28	29	58	1,1	–	1 000	0,64	**NATR 35 PP**
	35	28	29	58	1,1	–	1 000	0,55	**NATR 35 PPA**
	35	28	29	58	1,1	–	750	0,65	**NATV 35 PP**
	35	28	29	58	1,1	–	750	0,63	**NATV 35 PPA**
	35	28	29	44	1,1	0,6	2 600	0,63	**NUTR 35 A**
	35	28	29	44	1,1	0,6	1 800	0,63	**PWTR 35.2RS**
80	35	28	29	44	1,1	0,6	2 100	0,84	**NUTR 3580 A**
	35	28	29	44	1,1	0,6	1 800	0,84	**PWTR 3580.2RS**
	40	30	32	66	1,1	–	850	0,81	**NATR 40 PP**
	40	30	32	66	1,1	–	850	0,80	**NATR 40 PPA**
	40	30	32	66	1,1	–	650	0,89	**NATV 40 PP**
	40	30	32	66	1,1	–	650	0,83	**NATV 40 PPA**
	40	30	32	51	1,1	0,6	1 600	0,82	**NUTR 40 A**
	40	30	32	51	1,1	0,6	1 500	0,82	**PWTR 40.2RS**

[1] All support rollers of the PP design (designation printed in grey) will be gradually replaced by the PPA design

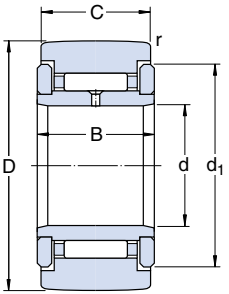


Series NUTR .. A Series PWTR.2RS

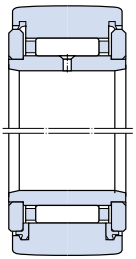
Designation[1]	Basic load ratings dynamic C	static C_0	Fatigue load limits P_u	Maximum radial forces dynamic F_r	static F_{0r}
–	N		N	N	
NUTR 2052 A	31 900	39 000	4 550	30 000	42 500
PWTR 2052.2RS	25 500	29 000	3 350	30 500	44 000
NATR 25	14 700	25 500	3 100	21 600	31 000
NATR 25 PP	14 700	25 500	3 100	21 600	31 000
NATR 25 PPA	14 700	25 500	3 100	21 600	31 000
NATV 25	19 800	44 000	5 300	28 500	40 500
NATV 25 PP	19 800	44 000	5 300	28 500	40 500
NATV 25 PPA	19 800	44 000	5 300	28 500	40 500
NUTR 25 A	29 700	36 000	4 250	18 000	25 500
PWTR 25.2RS	23 800	26 500	3 050	18 600	26 500
NUTR 2562 A	35 800	48 000	5 600	44 000	63 000
PWTR 2562.2RS	29 200	36 000	4 050	45 000	64 000
NATR 30	22 900	37 500	4 550	26 500	38 000
NATR 30 PP	22 900	37 500	4 550	26 500	38 000
NATR 30 PPA	22 900	37 500	4 550	26 500	38 000
NATV 30	29 200	62 000	7 650	34 500	49 000
NATV 30 PP	29 200	62 000	7 650	34 500	49 000
NATV 30 PPA	29 200	62 000	7 650	34 500	49 000
NUTR 30 A	41 300	47 500	5 850	24 000	34 500
PWTR 30.2RS	31 900	32 500	4 050	20 400	29 000
NUTR 3072 A	48 400	61 000	7 500	53 000	76 500
PWTR 3072.2RS	39 600	45 000	5 600	47 500	68 000
NATR 35 PP	24 600	43 000	5 300	33 500	48 000
NATR 35 PPA	24 600	43 000	5 300	33 500	48 000
NATV 35 PP	31 900	72 000	8 800	43 000	62 000
NATV 35 PPA	31 900	72 000	8 800	43 000	62 000
NUTR 35 A	45 700	57 000	6 950	33 500	47 500
PWTR 35.2RS	35 800	40 500	5 000	28 000	40 000
NUTR 3580 A	51 200	68 000	8 300	57 000	81 500
PWTR 3580.2RS	41 800	50 000	6 300	51 000	72 000
NATR 40 PP	31 900	57 000	7 100	41 500	58 500
NATR 40 PPA	31 900	57 000	7 100	41 500	58 500
NATV 40 PP	39 100	88 000	11 000	51 000	73 500
NATV 40 PPA	39 100	88 000	11 000	51 000	73 500
NUTR 40 A	57 200	72 000	9 000	32 000	45 500
PWTR 40.2RS	41 800	49 000	6 000	33 500	48 000

[1] All support rollers of the PP design (designation printed in grey) will be gradually replaced by the PPA design

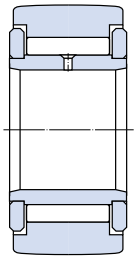
Support rollers with axial guidance
D **85 – 310** mm



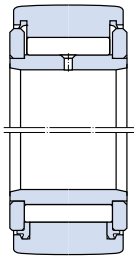
Series NATR



Series NATR .. PP
Series NATR .. PPA



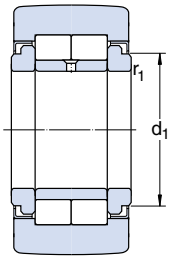
Series NATV



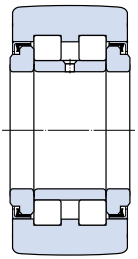
Series NATV .. PP
Series NATV .. PPA

Dimensions							Speed rating	Mass	Designation[1]
D	d	C	B	d_1	r min	r_1 min			
mm							r/min	kg	–
85	45	30	32	55	1,1	0,6	1 400	0,88	**NUTR 45 A**
	45	30	32	55	1,1	0,6	1 300	0,88	**PWTR 45.2RS**
90	40	30	32	51	1,1	0,6	1 600	1,13	**NUTR 4090 A**
	40	30	32	51	1,1	0,6	1 500	1,13	**PWTR 4090.2RS**
	50	30	32	76	1,1	–	650	0,96	**NATR 50 PP**
	50	30	32	76	1,1	–	650	0,87	**NATR 50 PPA**
	50	30	32	76	1,1	–	550	0,99	**NATV 50 PP**
	50	30	32	76	1,1	–	550	0,97	**NATV 50 PPA**
	50	30	32	60	1,1	0,6	1 300	0,95	**NUTR 50 A**
	50	30	32	60	1,1	0,6	1 100	0,95	**PWTR 50.2RS**
100	45	30	32	55	1,1	0,6	1 400	1,40	**NUTR 45100 A**
	45	30	32	55	1,1	0,6	1 300	1,40	**PWTR 45100.2RS**
110	50	30	32	60	1,1	0,6	1 300	1,70	**NUTR 50110 A**
	50	30	32	60	1,1	0,6	1 100	1,70	**PWTR 50110.2RS**
130	50	63	65	63	3	2	1 100	5,20	**NNTR 50×130×65.2ZL**
140	55	68	70	73	3	2	850	6,40	**NNTR 55×140×70.2ZL**
150	60	73	75	78	3	2	800	7,80	**NNTR 60×150×75.2ZL**
160	65	73	75	82	3	2	700	8,80	**NNTR 65×160×75.2ZL**
180	70	83	85	92	3	2	600	13,0	**NNTR 70×180×85.2ZL**
200	80	88	90	102	4	2	500	17,0	**NNTR 80×200×90.2ZL**
220	90	98	100	119	4	2,5	400	22,5	**NNTR 90×220×100.2ZL**
240	100	103	105	132	4	2,5	340	28,0	**NNTR 100×240×105.2ZL**
260	110	113	115	143	4	2,5	300	35,5	**NNTR 110×260×115.2ZL**
290	120	133	135	155	4	3	260	53,0	**NNTR 120×290×135.2ZL**
310	130	144	146	165	5	3	240	65,0	**NNTR 130×310×146.2ZL**

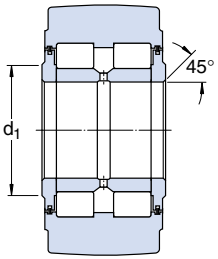
[1] All support rollers of the PP design (designation printed in grey) will be gradually replaced by the PPA design



Series NUTR .. A



Series PWTR.2RS



Series NNTR.2ZL

Designation[1]	**Basic load ratings** dynamic C	static C_0	**Fatigue load limits** P_u	**Maximum radial forces** dynamic F_r	static F_{0r}
–	N		N	N	
NUTR 45 A	58 300	75 000	9 300	32 500	46 500
PWTR 45.2RS	42 900	50 000	6 200	34 000	48 000
NUTR 4090 A	68 200	91 500	11 400	63 000	90 000
PWTR 4090.2RS	49 500	62 000	7 650	64 000	91 500
NATR 50 PP	30 800	58 500	7 200	40 000	57 000
NATR 50 PPA	30 800	58 500	7 200	40 000	57 000
NATV 50 PP	39 100	93 000	11 600	50 000	72 000
NATV 50 PPA	39 100	93 000	11 600	50 000	72 000
NUTR 50 A	58 300	78 000	9 650	32 500	47 500
PWTR 50.2RS	42 900	52 000	6 550	34 500	49 000
NUTR 45100 A	73 700	104 000	12 700	80 000	114 000
PWTR 45100.2RS	53 900	69 500	8 650	81 500	116 000
NUTR 50110 A	78 100	116 000	14 300	98 000	140 000
PWTR 50110.2RS	57 200	78 000	9 650	100 000	143 000
NNTR 50×130×65.2ZL	179 000	232 000	31 000	224 000	320 000
NNTR 55×140×70.2ZL	209 000	275 000	37 500	224 000	320 000
NNTR 60×150×75.2ZL	238 000	320 000	42 500	265 000	375 000
NNTR 65×160×75.2ZL	255 000	345 000	46 500	285 000	405 000
NNTR 70×180×85.2ZL	330 000	455 000	61 000	375 000	540 000
NNTR 80×200×90.2ZL	391 000	540 000	71 000	455 000	640 000
NNTR 90×220×100.2ZL	468 000	670 000	83 000	480 000	680 000
NNTR 100×240×105.2ZL	528 000	780 000	93 000	550 000	780 000
NNTR 110×260×115.2ZL	627 000	930 000	112 000	655 000	950 000
NNTR 120×290×135.2ZL	825 000	1 270 000	143 000	900 000	1 290 000
NNTR 130×310×146.2ZL	952 000	1 460 000	166 000	1 040 000	1 500 000

[1] All support rollers of the PP design (designation printed in grey) will be gradually replaced by the PPA design


SKF

Cam followers

Product tables **page192**

Cam followers are essentially needle or cylindrical roller bearings with a thick-walled outer ring. The outside surface of the outer ring is crowned which serves to prevent edge stresses if the cam follower runs in a tilted or inclined position. Cam followers are ready-to-mount units which are filled with grease. They are suitable for all types of cam drives, tracks and conveyor systems etc.

Instead of an inner ring cam followers have a solid stud (pin) which 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 side washer or flange ring pressed on to the stud, or by the roller complement.

SKF cam followers are available in three different designs which have the same dimensions and differ only in their internal design. Generally, the cam followers have a concentric seating on the stud (➔ **fig** 1), but some are also available with an eccentric collar which is shrunk on to the stud (➔ **fig** 2). Cam followers with eccentric collar enable an optimum interaction with the cam to be obtained and also allow less stringent manufacturing tolerances to be used for the associated components.

Fig 1

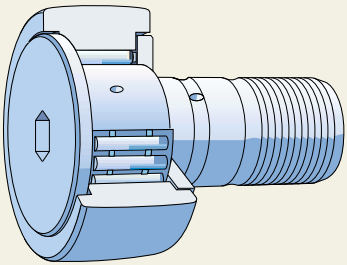
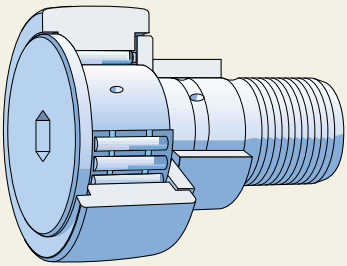


Fig 2



Cam followers of the KR design

KR cam followers (➔ **fig** 1, **page 181**) are fitted with needle rollers. This allows for a very thick-walled outer ring so that heavy and also shock loads can be supported. Axial guidance is achieved via the integral flange on the stud and a pressed on side washer. With the exception of a few sizes of the basic design, which are available with or without seals, the cam followers are produced as standard fitted with rubbing seals.

Sealed KR cam followers of the

- PP design (➔ **fig** 3) and PPB design (➔ **fig** 4) have seals of nitrile rubber (NBR) or polyurethane at both sides and are suitable for operating temperatures from –30 to +100 °C.
- PPA design (➔ **fig** 5) have sliding thrust washers of polyamide 6,6. These reduce the sliding friction between the outer ring and side washer or flange and allow a reduction in the running temperature of the cam follower; this is favourable with regard to the service life of the grease. The sliding washer has the form of a cup spring with a sealing lip and acts as an axial seal which reliably retains the grease. In the radial direction a narrow labyrinth is formed with the outer ring which excludes coarse contaminants. The permissible operating temperature range for the sealed cam followers is –30 to +100 °C.

KR cam followers of the PPA design are being gradually introduced to replace the PP and PPB designs which will no longer be produced.

All cam followers of the PPA design have an enhanced runner profile (outside diameter of outer ring). The new design allows a more favourable distribution of stress than the crowned profile of the earlier design, even when running in a tilted position. This leads to higher stiffness and less wear between the runner surface and its counterface.

Fig 3

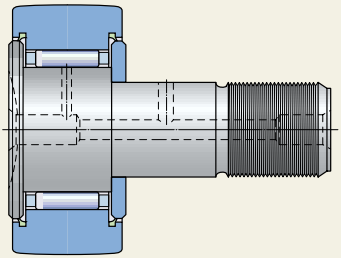


Fig 4

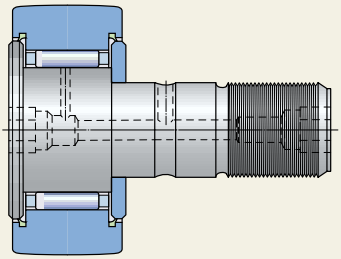
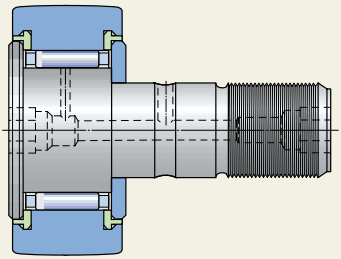


Fig 5



Basic design, series KR

Cam followers of series KR (➔ **fig** 1, **page 181**) have a cage-guided roller complement. The cage is of steel and guides the rollers along their whole length, making relatively high speed operation possible.

The head of the stud of sizes 16 and 19 (➔ **fig** 6) has a slot and a lubrication hole to take a grease nipple. They may also be supplied with an internal hexagon in the head instead. Such cam followers are identified by the suffix SK and cannot be relubricated.

Cam followers of size 22 and larger of the B, PPA and PPB designs have an internal hexagon at the head and threaded ends of the stud for use when mounting (➔ **figs** 4 and 5). The other designs have a slot (➔ **fig** 3). All sizes from size 22 have lubrication holes at both ends to take grease nipples. Appropriate grease nipples are supplied with the cam followers. Other grease nipples should not be used.

From size 35, the lubrication holes are also suitable to take adapters for connection to centralised lubrication systems. More details will be found under the heading "Accessories" on **page 186**.

Cam followers with eccentric collar, series KRE

The design of these cam followers is the same as the basic design except that they have a shrunk-on eccentric collar (➔ **fig** 7). They can only be relubricated through the ends of the stud.

Full complement cam followers, series KRV

These cam followers incorporate the maximum number of needle rollers (➔ **fig** 8) and can therefore support very heavy loads. Because of the special kinematic conditions, however, they cannot operate at such high speeds as the KR cam followers. More frequent relubrication is also required.

Fig 6

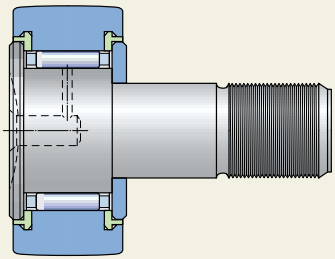


Fig 7

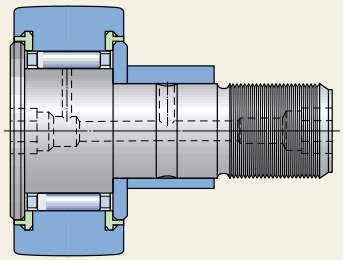
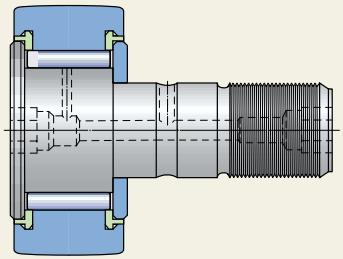


Fig 8



Cam followers of the NUKR design

Cam followers of the NUKR design (➔ **fig** 9) are based on double row full complement cylindrical roller bearings. The outer ring has two integral flanges which axially guide the roller complement. The stud head and a flange ring which is pressed on to the stud shank guide the outer ring axially via the rollers. Sheet metal angle rings which are pressed into the outer ring and extend over the stud head and the flange ring provide efficient labyrinth seals.

The NUKR cam followers are suitable for heavy radial loads and, as the outer ring is axially guided by the rollers, they can also support heavy axial loads. They also permit relatively high speed operation. However, because of the full complement of rollers they require frequent relubrication. Grease can be supplied through the ends of the stud or through the lubrication hole in the stud shank.

The cam followers of the NUKRE design have an eccentric collar which is shrunk on to the stud (➔ **fig** 10). As the collar covers the lubrication hole in the shank, these cam followers can only be relubricated via the ends of the stud.

Cam followers of the NUKR(E) design have an internal hexagon at the head and threaded ends which can be used for holding the cam follower during mounting. The lubrication holes at both ends are designed to take a grease nipple or an adapter for connection to a centralised lubrication system (➔ "Accessories", **page 186**). To differentiate from an earlier design which had a groove instead of the internal hexagon in the head and which could only take a grease nipple and not an adapter, these newer cam followers are identified by suffix A in the designation during a transition period, e.g. NUKR(E) 47 A.

The cam followers identified by suffix A have an enhanced runner profile (outside diameter of outer ring). The new design allows a more favourable distribution of stress than the crowned profile of the earlier design, even when running in a tilted position. This leads to higher stiffness and less wear between the runner surface and its counterface.

Fig 9

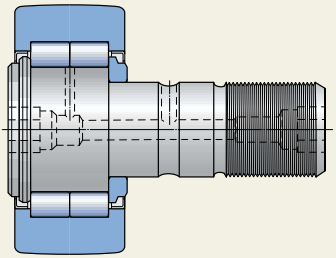
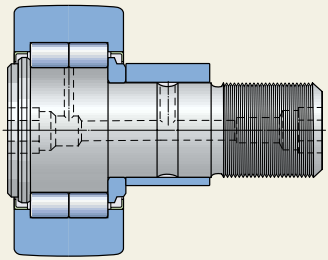


Fig 10



Cam followers of the PWKR design

These cam followers (➔ **fig** 11) are fitted with rubbing seals (designation suffix .2RS) and are therefore particularly suitable for operation under arduous conditions. The outer ring has three integral flanges which provide axial guidance separately for the two rows of rollers (full complement). The stud head and a flange ring which is pressed on to the stud shank guide the outer ring axially via the rollers. The separate guidance of the two rows of rollers reduces the friction and thus heat generation. These cam followers are therefore suitable for the accommodation of heavy and even constantly acting axial loads such as are produced when the cam followers operate in an inclined position.

The particular characteristics of these cam followers are their seals and the large space between the roller rows. Sheet metal angle rings which are pressed into the outer ring serve as secondary seals. The primary seals consist of sealing lips of oil and wear-resistant nitrile rubber (NBR). The lips are vulcanised to the inside of the angle rings and exert a light pressure on the head and flange ring. These sealing lips greatly enhance the sealing efficiency both outwards and inwards. The large space between the two roller rows means that a large quantity of grease can be incorporated. The seals and grease limit the permissible operating temperature range to –25 to +120 °C.

Cam followers of the PWKR.2RS design can be operated for long periods without relubrication even where conditions are difficult. Relubrication is simple and can be accomplished via the holes at the head and threaded ends of the stud. These will take grease nipples or adapters for connection to centralised lubrication systems (➔ "Accessories", **page 186**)

Cam followers of the PWKRE.2RS design have a shrunk on eccentric collar (➔ **fig** 12). As this covers the lubrication hole in the shank, it is only possible to relubricate through the stud ends.

Fig 11

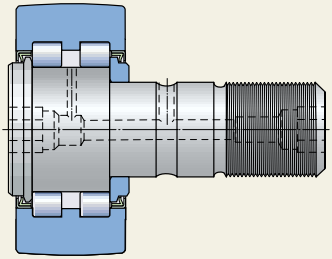
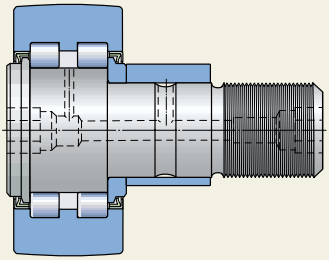


Fig 12



Accessories

These accessories are intended to ensure reliable lubrication and location of the cam followers. Some of the accessories are supplied with the cam followers (➔ **Table** 1) whilst others must be ordered separately.

Grease nipples

Grease nipples with cylindrical shank are supplied loose with the cam followers and must be inserted as required. Dimensions are given in **Table** 2.

Plugs

The end of the relubrication duct in the shank of KR cam followers not required for relubrication should be plugged. The plug should be pressed into place using a mandrel (➔ **Table** 3).

Table 1

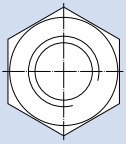
Accessories for cam followers



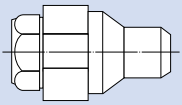
Grease nipple



Plug



Hexagonal nut



Adapter

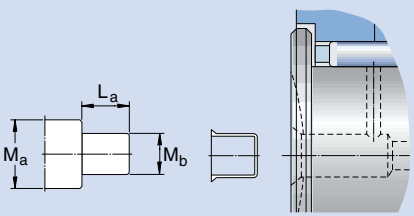
Cam follower Design	Size without seals	with seals	**Supplied with cam follower** Grease nipple	Plug	Hexagonal nut	**To be ordered separately** Adapter
KR	**16**	**16 PP/A**	NIP A1	VD1	M 6 × 1	–
KRE	**–**	**16 PPSK/A**	–	–	M 6 × 1	–
KRV	**19**	**19 PP/A**	NIP A1	VD1	M 8×1,25	–
	–	**19 PPSK/A**	–	–	M 8×1,25	–
	22	**22 PP**	1 × NIP A1	VD1	M 10×1	–
	22 B	**22 PPA**	2 × NIP A1×4,5	–	M 10×1	–
	26	**26 PP**	1 × NIP A1	VD1	M 10×1	–
	26 B	**26 PPA**	2 × NIP A1×4,5	–	M 10×1	–
	30	**30 PP**	1 × NIP A2	VD2	M 12×1,5	–
	30 B	**30 PPA**	2 × NIP A1×4,5	–	M 12×1,5	–
	32	**32 PP**	1 × NIP A2	VD2	M 12××1,5	–
	32 B	**32 PPA**	2 × NIP A1×4,5	–	M 12×1,5	–
	35	**35 PP**	1 × NIP A2	VD2	M 16×1,5	–
	35 B	**35 PPA**	2 × NIP A2×7,5	–	M 16×1,5	AP 8
	40	**40 PP**	1 × NIP A2	VD2	M 18×1,5	–
	40 B	**40 PPA**	2 × NIP A2×7,5	–	M 18×1,5	AP 8
	–	**47 PP**	1 × NIP A3	VD3	M 20×1,5	–
	–	**47 PPA**	2 × NIP A2×7,5	–	M 20×1,5	AP 10
	–	**52 PP**	1 × NIP A3	VD3	M 20×1,5	–
	–	**52 PPA**	2 × NIP A2×7,5	–	M 20×1,5	AP 10
	–	**62 PPA/B**	2 × NIP A3×9,5	–	M 24×1,5	AP 14
	–	**72 PPA/B**	2 × NIP A3×9,5	–	M 24×1,5	AP 14
	–	**80 PPA/B**	2 × NIP A3×9,5	–	M 30×1,5	AP 14
	–	**90 PPA/B**	2 × NIP A3×9,5	–	M 30×1,5	AP 14
NUKR	**–**	**35**	2 × NIP A2×7,5	–	M 16×1,5	AP 8
NUKRE	**–**	**40**	2 × NIP A2×7,5	–	M 18×1,5	AP 8
PWKR	**–**	**47**	2 × NIP A2×7,5	–	M 20×1,5	AP 10
PWKRE	**–**	**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

Hexagonal nuts

Hexagonal nuts to ISO 4032:1986 or ISO 8673:1988, for the attachment of cam followers to the appropriate components, are also supplied loose with each cam follower. The nuts are of strength class 8.8 and are zinc galvanised to ISO 4042:1989. The dimensions and recommended tightening torques are given in **Table** 4.

Table 3

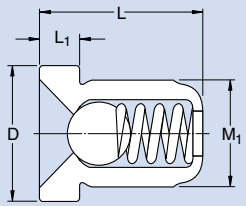
Plugs



Plug Designation	Nominal diameter	Mandrel Dimensions M_a	M_b	L_a
–	mm			
VD1	4	10	2,7	5,2
VD2	6	12	4,7	7,3
VD3	8	15	6,7	10

Table 2

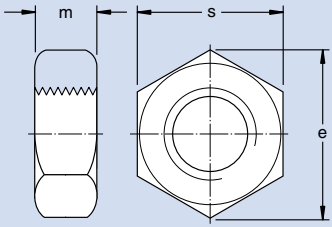
Grease nipples



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	6	8	9	2
NIP A2×7,5	6	7,5	7,5	2
NIP A3	8	10	12	3
NIP A3×9,5	8	10	9,5	3

Table 4

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] ISO 4032:1986
ISO 8673:1988

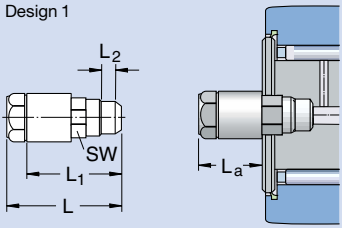
Adapters for connection to centralised lubrication system

Adapters of type AP are intended to enable cam followers to be relubricated via a centralised lubrication system. They consist of a connection and a quick closure which will take, for example, polyamide tubing 4×0,75 to DIN 73378:1996 (➔ **fig** 13). The designs and dimensions are given in **Table** 5.

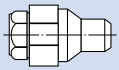
Table 5

Adapters

Design 1

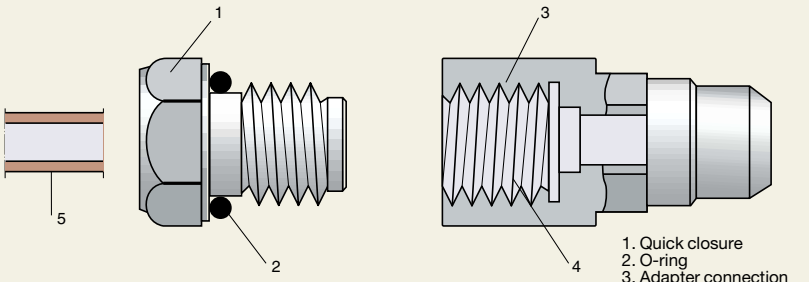


Design 2



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 13



1. Quick closure
2. O-ring
3. Adapter connection
4. Female thread M 10×1
5. Polyamide tubing

Dimensions

The dimensions of the cam followers conform to ISO 6278-1980 and, where standardised to ANSI/AFBMA Standard 18.1-1976.

Tolerances

SKF cam rollers are produced to Normal tolerances to ISO 492:1994 (➔ **Table** 2, **page 17**) except for

– the tolerance of the profiled outside diameter which is 0/–0,050 mm,
– the shank diameter tolerance which is h7, and
– the eccentric diameter tolerance which is h9.

The limits for tolerances h7 and h9 will be found in **Table** 6.

Table 6

ISO tolerances

Nominal dimension over	incl.	**h7** Deviations high	low	**h9** Deviations 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 cam followers have a radial internal clearance in the C2 range for cylindrical and needle roller bearings corresponding to class 2 according to ISO 5793:1991. The values are given in **Table** 6, **page 21**.

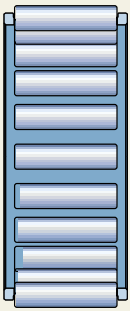
Load carrying capacity

In contrast to normal roller bearings, where the outer ring is supported over its entire surface in the bore of a housing, the outer ring of a cam follower only has a small area of contact with the surface against which it runs The deformation of the outer ring caused by this limited contact alters the force distribution in the bearing and thus has an influence on life and load carrying capacity. The basic load ratings given in the product tables take this influence into account.

The ability to carry dynamic loads depends on the requisite life, but it is important with reference to the strength of the outer ring that the value of the maximum dynamic radial load F_r is not exceeded.

The permissible static load for a cam follower is determined by the smaller of the values of F_{0r} and C_0. If requirements regarding smooth running are small, the static load may exceed C_0 but should never exceed the maximum permissible static radial load F_{0r}.

Fig 14



Cages

The cages of cam followers of the KR design are made of steel (➔ **fig** 14).

Lubrication

All cam followers are supplied as standard filled with a high-quality lithium base grease of NLGI class 2 consistency. The grease is based on mineral oil and has good rust inhibiting properties. It has an operating temperature range of –25 to +150 °C.

SKF cam followers require little maintenance. To exploit their full service life, they must, however, be relubricated. This can be done through ducts in the stud (**➔ fig 15**)

– from the head (1) side (bearing end),
– from the threaded end (2), and
– through the shank (3)

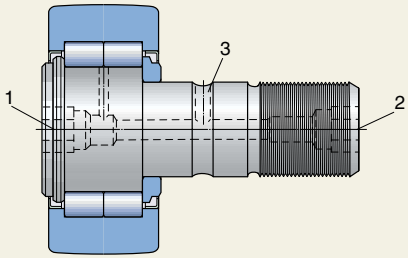
except for the following:

– cam followers KR 16 and KR 19, which can only be relubricated via the head;
– cam followers KR 16 and KR 19 in the PPSK and PPSKA designs which cannot be relubricated;
– cam followers with eccentric collar; the collar covers the relubrication hole in the stud shank so that they can only be relubricated via the stud ends.

Relubrication should preferably be undertaken while the first grease fill still has its full lubricating properties. Generally, where loads are light, speeds relatively low and the surroundings clean, cam followers can operate for long periods without relubrication. If, however, the environment is contaminated and damp, or if they operate for long periods at high speeds or temperatures higher than +70 °C, they must be relubricated frequently.

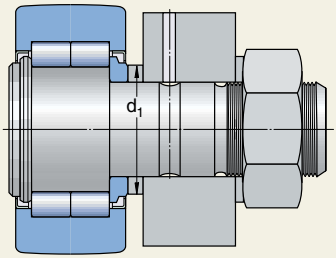
For relubrication it is recommended that SKF grease be used – grease LGMT 2 or preferably LGWA 2. This is a lithium complex grease with a mineral oil base and has good rust inhibiting properties.

Fig 15



Design of associated components
The side washers and flange rings which are pressed on to the stud shank should, where possible, be supported over their entire face. It is therefore recommended that the support surface should have a diameter corresponding to the dimension d_1 (→ **fig** 16). The bore to take the stud should be machined to tolerance H7. For cam followers which are subjected to shock loads, the stud should preferably be mounted without clearance in its bore. It is also recommended that recommended torques given in **Table** 4 on **page 187** for tightening the nuts be respected. If the requisite tightening torque cannot be achieved, the stud should be mounted with an interference fit.

Fig 16



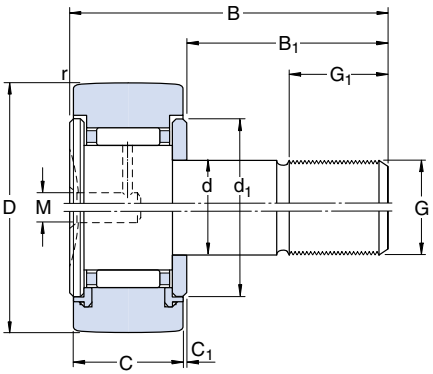
Mounting instructions
Cam followers can be attached to associated components using conventional hexagonal nuts (→ **fig** 16). Appropriate nuts as shown in **Table** 1 on **page 186** are supplied with each cam follower. To lock them, spring washers, for example to DIN 128:1994 are adequate.

It is recommended that the nuts be tightened to the torques quoted in **Table** 4 on **page 187**. Only then will the full load carrying potential of the cam followers be available. A suitable tool can be inserted in the groove or internal hexagon at the head or threaded end of the stud to hold it while the nut is being tightened.

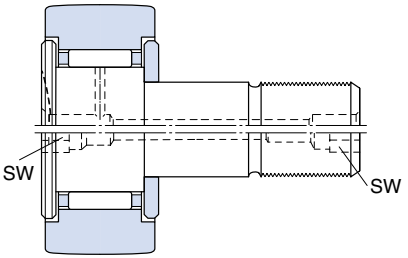
Depending on the mounting conditions, cam followers with eccentric collar can be adjusted to the required eccentricity via the groove or internal hexagon.

Blows to the head of the stud should be avoided. Care should also be taken to see that the lubrication hole lies in the unloaded zone. The position of this hole corresponds to the trademark on the stud head. The lubrication hole in the stud shank lies in the same direction and can be used for cam followers without eccentric collar either for relubrication purposes or for a locking device to prevent the stud from turning.

Cam followers
D **16 – 22** mm



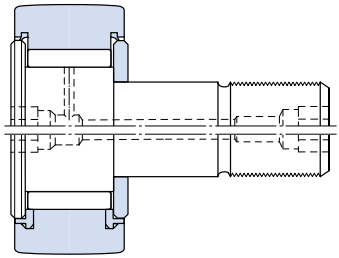
Series KR 16, KR 19
Series KR 16 PPA, KR 19 PPA



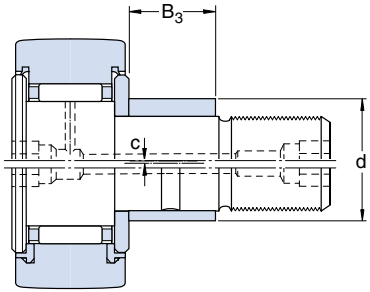
Series KR 22
Series KR 22 B

Dimensions Cam follower												Eccentric collar		Mass	Designation[1]
D	C	d	B	B_1	C_1	d_1	G	G_1	M	r min	SW	c	B_3		
mm														kg	–
16	11	6	28	16	0,6	12,5	M 6	8	4	0,15	–	–	–	0,019	**KR 16**
	11	6	28	16	0,6	12	M 6	8	4	0,15	–	–	–	0,018	KR 16 PP
	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	–	–	0,019	KR 16 PPSK[2]
	11	6	28	16	0,6	12,5	M 6	8	–	0,15	4	–	–	0,019	**KR 16 PPSKA**[2]
	11	6	28	16	0,6	12	M 6	8	4	0,15	–	–	–	0,020	KRV 16 PP
	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	M 6	8	4	0,15	–	0,5	7	0,020	KRE 16 PP
	11	9	28	16	0,6	12,5	M 6	8	4	0,15	–	0,5	7	0,020	**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	14	M 8	10	4	0,15	–	–	–	0,028	KR 19 PP
	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 PPSK[2]
	11	8	32	20	0,6	15	M 8	10	–	0,15	4	–	–	0,029	**KR 19 PPSKA**[2]
	11	8	32	20	0,6	14	M 8	10	4	0,15	–	–	–	0,032	KRV 19 PP
	11	8	32	20	0,6	15	M 8	10	4	0,15	–	–	–	0,031	**KRV 19 PPA**
	11	11	32	20	0,6	14	M 8	10	4	0,15	–	0,5	9	0,031	KRE 19 PP
	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	M 10×1	12	4	0,3	–	–	–	0,044	KR 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	M 10×1	12	4	0,3	–	–	–	0,044	KR 22 PP
	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	M 10×1	12	4	0,3	–	–	–	0,045	KRV 22 PP
	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	M 10×1	12	4	0,3	–	0,5	10	0,048	KRE 22 PP
	12	13	36	23	0,6	17,5	M 10×1	12	–	0,3	5	0,5	10	0,047	**KRE 22 PPA**

[1] All cam followers of the KR design where the designation is printed in grey are gradually being replaced by more robust designs
[2] Internal hexagon in the stud head only; cannot be relubricated



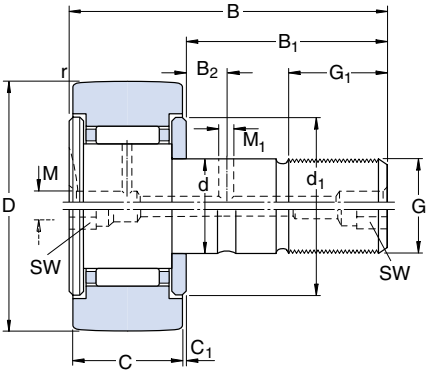
Series KRV 22 PP
Series KRV 22 PPA



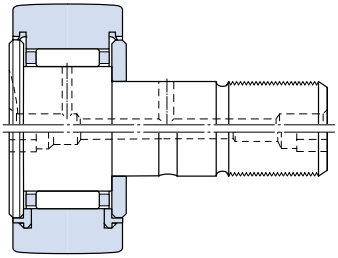
Series KRE 22 PP
Series KRE 22 PPA

Designation[1]	**Basic load ratings** dynamic C	static C_0	**Fatigue load limit** P_u	**Maximum radial forces** dynamic F_r	static F_{0r}	**Speed rating**
–	N		N	N		r/min
KR 16	3 140	3 200	345	2 900	4 150	14 000
KR 16 PP	3 140	3 200	345	2 900	4 150	14 000
KR 16 PPA	3 140	3 200	345	2 900	4 150	14 000
KR 16 PPSK	3 140	3 200	345	2 900	4 150	14 000
KR 16 PPSKA	3 140	3 200	345	2 900	4 150	14 000
KRV 16 PP	4 730	6 550	720	4 050	5 700	3 800
KRV 16 PPA	4 730	6 550	720	4 050	5 700	3 800
KRE 16 PP	3 140	3 200	345	2 900	4 150	14 000
KRE 16 PPA	3 140	3 200	345	2 900	4 150	14 000
KR 19	3 470	3 800	415	3 800	5 500	11 000
KR 19 PP	3 470	3 800	415	3 800	5 500	11 000
KR 19 PPA	3 470	3 800	415	3 800	5 500	11 000
KR 19 PPSK	3 470	3 800	415	3 800	5 500	11 000
KR 19 PPSKA	3 470	3 800	415	3 800	5 500	11 000
KRV 19 PP	5 280	8 000	880	5 100	7 350	3 100
KRV 19 PPA	5 280	8 000	880	5 100	7 350	3 100
KRE 19 PP	3 470	3 800	415	3 800	5 500	11 000
KRE 19 PPA	3 470	3 800	415	3 800	5 500	11 000
KR 22	4 400	5 000	560	4 250	6 000	8 000
KR 22 B	4 400	5 000	560	4 250	6 000	8 000
KR 22 PP	4 400	5 000	560	4 250	6 000	8 000
KR 22 PPA	4 400	5 000	560	4 250	6 000	8 000
KRV 22 PP	6 050	9 150	1 040	5 700	8 150	2 600
KRV 22 PPA	6 050	9 150	1 040	5 700	8 150	2 600
KRE 22 PP	4 400	5 000	560	4 250	6 000	8 000
KRE 22 PPA	4 400	5 000	560	4 250	6 000	8 000

[1] All cam followers of the KR design where the designation is printed in grey are gradually being replaced by more robust designs



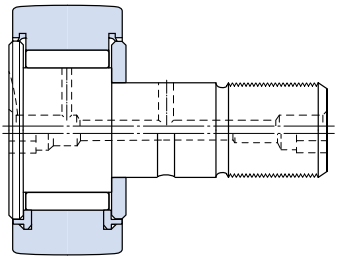
Series KR
Series KR .. B



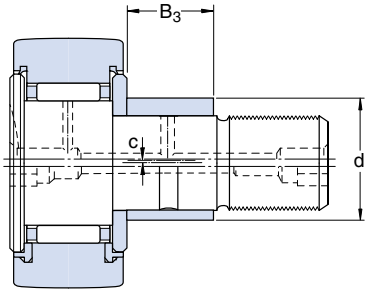
Series KR .. PP
Series KR .. PPA

Dimensions Cam follower														Eccentric collar		**Mass**	**Designation**[1]
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	–
26	12	10	36	23	–	0,6	17	M 10×1	12	4	–	0,3	–	–	–	0,058	KR 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	M 10×1	12	4	–	0,3	–	–	–	0,058	KR 26 PP
	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	M 10×1	12	4	–	0,3	–	–	–	0,061	KRV 26 PP
	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	M 10×1	12	4	–	0,3	–	0,5	10	0,062	KRE 26 PP
	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	6	3	0,6	–	–	–	0,087	KR 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	6	3	0,6	–	–	–	0,087	KR 30 PP
	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	6	3	0,6	–	–	–	0,089	KRV 30 PP
	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	–	0,6	23	M 12×1,5	13	6	–	0,6	–	0,5	11	0,093	KRE 30 PP
	14	15	40	25	–	0,6	23	M 12×1,5	13	–	–	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	6	3	0,6	–	–	–	0,098	KR 32
	14	12	40	25	6	0,6	23	M 12×1,5	13	–	3	0,6	6	–	–	0,10	**KR 32 B**
	14	12	40	25	6	0,6	23	M 12×1,5	13	6	3	0,6	–	–	–	0,098	KR 32 PP
	14	12	40	25	6	0,6	23	M 12×1,5	13	–	3	0,6	6	–	–	0,098	**KR 32 PPA**
	14	12	40	25	6	0,6	23	M 12×1,5	13	6	3	0,6	–	–	–	0,10	KRV 32 PP
	14	12	40	25	6	0,6	23	M 12×1,5	13	–	3	0,6	6	–	–	0,10	**KRV 32 PPA**
	14	15	40	25	–	0,6	23	M 12×1,5	13	6	–	0,6	–	0,5	11	0,10	KRE 32 PP
	14	15	40	25	–	0,6	23	M 12×1,5	13	–	–	0,6	6	0,5	11	0,10	**KRE 32 PPA**

[1] All cam followers of the KR design where the designation is printed in grey are gradually being replaced by more robust designs



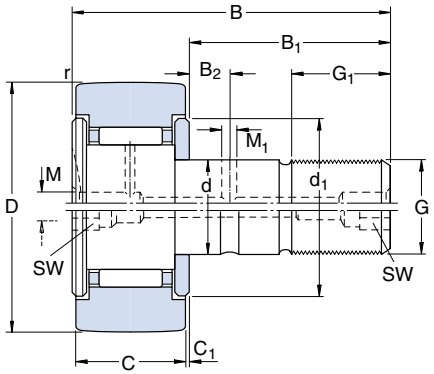
Series KRV .. PP
Series KRV .. PPA



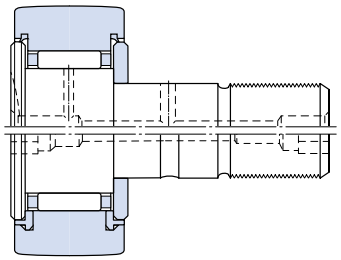
Series KRE .. PP
Series KRE .. PPA

Designation[1]	Basic load ratings dynamic C	static C_0	Fatigue load limit P_u	Maximum radial forces dynamic F_r	static F_{0r}	Speed rating
–	N		N	N		r/min
KR 26	4 840	6 000	655	9 300	13 200	8 000
KR 26 B	4 840	6 000	655	9 300	13 200	8 000
KR 26 PP	4 840	6 000	655	9 300	13 200	8 000
KR 26 PPA	4 840	6 000	655	9 300	13 200	8 000
KRV 26 PP	6 820	11 000	1 250	11 400	16 300	2 600
KRV 26 PPA	6 820	11 000	1 250	11 400	16 300	2 600
KRE 26 PP	4 840	6 000	655	9 300	13 200	8 000
KRE 26 PPA	4 840	6 000	655	9 300	13 200	8 000
KR 30	6 440	8 000	880	7 800	11 200	5 500
KR 30 B	6 440	8 000	880	7 800	11 200	5 500
KR 30 PP	6 440	8 000	880	7 800	11 200	5 500
KR 30 PPA	6 440	8 000	880	7 800	11 200	5 500
KRV 30 PP	8 970	14 600	1 660	11 000	15 600	2 100
KRV 30 PPA	8 970	14 600	1 660	11 000	15 600	2 100
KRE 30 PP	6 440	8 000	880	7 800	11 200	5 500
KRE 30 PPA	6 440	8 000	880	7 800	11 200	5 500
KR 32	6 710	8 500	950	10 600	15 000	5 500
KR 32 B	6 710	8 500	950	10 600	15 000	5 500
KR 32 PP	6 710	8 500	950	10 600	15 000	5 500
KR 32 PPA	6 710	8 500	950	10 600	15 000	5 500
KRV 32 PP	9 350	15 300	1 760	14 300	20 400	2 100
KRV 32 PPA	9 350	15 300	1 760	14 300	20 400	2 100
KRE 32 PP	6 710	8 500	950	10 600	15 000	1 550
KRE 32 PPA	6 710	8 500	950	10 600	15 000	1 550

[1] All cam followers of the KR design where the designation is printed in grey are gradually being replaced by more robust designs



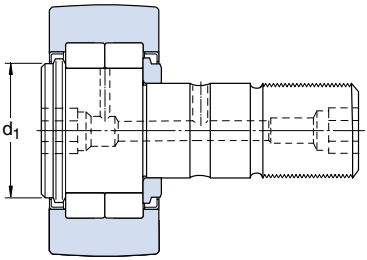
Series KR
Series KR .. B



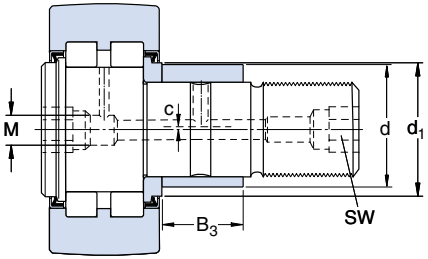
Series KR .. PP
Series KR .. PPA

Dimensions Cam follower														Eccentric collar		**Mass**	**Designation**[1]
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	M 16×1,5	17	6	3	0,6	–	–	–	0,17	KR 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	M 16×1,5	17	6	3	0,6	–	–	–	0,17	KR 35 PP
	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	M 16×1,5	17	6	3	0,6	–	–	–	0,17	KRV 35 PP
	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	7,8	0,8	20	M 16×1,5	17	–	3	0,6	8	–	–	0,16	**NUKR 35 A**
	18	16	52	32,5	7,8	0,8	20	M 16×1,5	17	–	3	0,6	8	–	–	0,16	**PWKR 35.2RS**
	18	20	52	32,5	–	0,8	27	M 16×1,5	17	6	–	0,6	–	1	14	0,18	KRE 35 PP
	18	20	52	32,5	–	0,8	27,6	M 16×1,5	17	–	–	0,6	8	1	14	0,18	**KRE 35 PPA**
	18	20	52	29,5	–	3,8	27	M 16×1,5	17	–	–	0,6	8	1	12	0,18	**NUKRE 35 A**
	18	20	52	29,5	–	3,8	27	M 16×1,5	17	–	–	0,6	8	1	12	0,18	**PWKRE 35.2RS**
40	20	18	58	36,5	8	0,8	32	M 18×1,5	19	6	3	1	–	–	–	0,25	KR 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	32	M 18×1,5	19	6	3	1	–	–	–	0,25	KR 40 PP
	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	32	M 18×1,5	19	6	3	1	–	–	–	0,25	KRV 40 PP
	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	–	3	1	8	–	–	0,24	**NUKR 40 A**
	20	18	58	36,5	8	0,8	22	M 18×1,5	19	–	3	1	8	–	–	0,24	**PWKR 40.2RS**
	20	22	58	36,5	–	0,8	32	M 18×1,5	19	6	–	1	–	1	16	0,26	KRE 40 PP
	20	22	58	36,5	–	0,8	31,5	M 18×1,5	19	–	–	1	8	1	16	0,26	**KRE 40 PPA**
	20	22	58	33,5	–	3,8	30	M 18×1,5	19	–	–	1	8	1	14	0,26	**NUKRE 40 A**
	20	22	58	33,5	–	3,8	30	M 18×1,5	19	–	–	1	8	1	14	0,26	**PWKRE 40.2RS**

[1] All cam followers of the KR design where the designation is printed in grey are gradually being replaced by more robust designs



Series NUKR

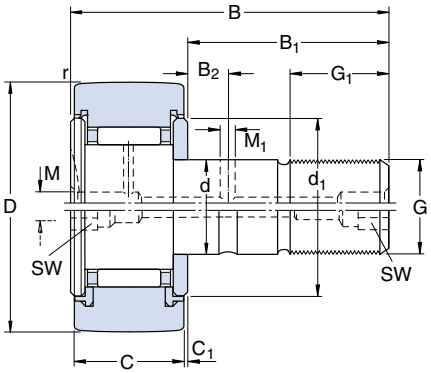


Series PWKRE.2RS

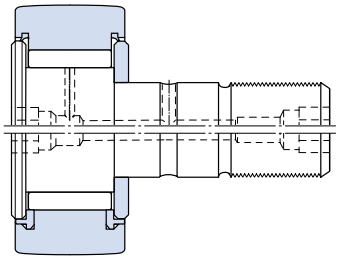
Designation[1]	Basic load ratings dynamic C	static C_0	Fatigue load limit P_u	Maximum radial forces dynamic F_r	static F_{0r}	Speed rating
–	N		N	N		r/min
KR 35	9 520	13 700	1 560	11 400	16 300	3 600
KR 35 B	9 520	13 700	1 560	11 400	16 300	3 600
KR 35 PP	9 520	13 700	1 560	11 400	16 300	3 600
KR 35 PPA	9 520	13 700	1 560	11 400	16 300	3 600
KRV 35 PP	12 300	23 200	2 700	14 600	20 800	1 600
KRV 35 PPA	12 300	23 200	2 700	14 600	20 800	1 600
NUKR 35 A	16 800	17 600	2 000	8 650	12 200	6 500
PWKR 35.2RS	11 900	11 400	1 200	8 650	12 500	6 000
KRE 35 PP	9 520	13 700	1 560	11 400	16 300	3 600
KRE 35 PPA	9 520	13 700	1 560	11 400	16 300	3 600
NUKRE 35 A	16 800	17 600	2 000	8 650	12 200	6 500
PWKRE 35.2RS	11 900	11 400	1 200	8 650	12 500	6 000
KR 40	10 500	14 600	1 730	12 500	18 000	2 900
KR 40 B	10 500	14 600	1 730	12 500	18 000	2 900
KR 40 PP	10 500	14 600	1 730	12 500	18 000	2 900
KR 40 PPA	10 500	14 600	1 730	12 500	18 000	2 900
KRV 40 PP	14 200	26 500	3 100	17 000	24 500	1 400
KRV 40 PPA	14 200	26 500	3 100	17 000	24 500	1 400
NUKR 40 A	19 000	22 000	2 500	14 000	20 000	5 500
PWKR 40.2RS	13 800	14 300	1 500	13 700	19 600	5 000
KRE 40 PP	10 500	14 600	1 730	12 500	18 000	2 900
KRE 40 PPA	10 500	14 600	1 730	12 500	18 000	2 900
NUKRE 40 A	19 000	22 000	2 500	14 000	20 000	5 500
PWKRE 40.2RS	13 800	14 300	1 500	13 700	19 600	5 000

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Cam followers
D **47 – 62** mm



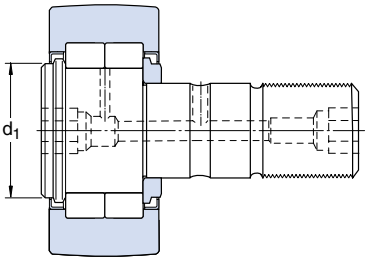
Series KR .. PP
Series KR .. PPA



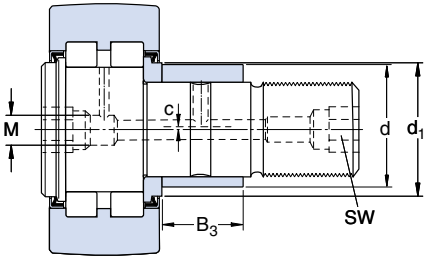
Series KRV .. PPB
Series KRV .. PPA

Dimensions Cam follower														Eccentric collar		Mass	Designation[1]
D	C	d	B	B_1	B_2	C_1	d_1	G	G_1	M	M_1 min	r	SW	c	B_3		
mm																kg	–
47	24	20	66	40,5	9	0,8	37	M 20×1,5	21	8	4	1	–	–	–	0,39	KR 47 PP
	24	20	66	40,5	9	0,8	36,5	M 20×1,5	21	–	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	–	–	–	0,39	KRV 47 PP
	24	20	66	40,5	9	0,8	36,5	M 20×1,5	21	–	4	1	10	–	–	0,39	**KRV 47 PPA**
	24	20	66	40,5	9	0,8	27	M 20×1,5	21	–	4	1	10	–	–	0,38	**NUKR 47 A**
	24	20	66	40,5	9	0,8	27	M 20×1,5	21	–	4	1	10	–	–	0,38	**PWKR 47.2RS**
	24	24	66	40,5	–	0,8	37	M 20×1,5	21	8	–	1	–	1	18	0,41	KRE 47 PP
	24	24	66	40,5	–	0,8	36,5	M 20×1,5	21	–	–	1	10	1	18	0,41	**KRE 47 PPA**
	24	24	66	40,5	–	0,8	27	M 20×1,5	21	–	–	1	10	1	18	0,40	**NUKRE 47 A**
	24	24	66	40,5	–	0,8	27	M 20×1,5	21	–	–	1	10	1	18	0,40	**PWKRE 47.2RS**
52	24	20	66	40,5	9	0,8	37	M 20×1,5	21	8	4	1	–	–	–	0,46	KR 52 PP
	24	20	66	40,5	9	0,8	36,5	M 20×1,5	21	–	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	–	–	–	0,46	KRV 52 PP
	24	20	66	40,5	9	0,8	36,5	M 20×1,5	21	–	4	1	10	–	–	0,46	**KRV 52 PPA**
	24	20	66	40,5	9	0,8	31	M 20×1,5	21	–	4	1	10	–	–	0,45	**NUKR 52 A**
	24	20	66	40,5	9	0,8	31	M 20×1,5	21	–	4	1	10	–	–	0,45	**PWKR 52.2RS**
	24	24	66	40,5	–	0,8	37	M 20×1,5	21	8	–	1	–	1	18	0,48	KRE 52 PP
	24	24	66	40,5	–	0,8	36,5	M 20×1,5	21	–	–	1	10	1	18	0,47	**KRE 52 PPA**
	24	24	66	40,5	–	0,8	31	M 20×1,5	21	–	–	1	10	1	18	0,47	**NUKRE 52 A**
	24	24	66	40,5	–	0,8	31	M 20×1,5	21	–	–	1	10	1	18	0,47	**PWKRE 52.2RS**
62	29	24	80	49,5	11	0,8	44	M 24×1,5	25	–	4	1	14	–	–	0,79	KR 62 PPB
	29	24	80	49,5	11	0,8	44	M 24×1,5	25	–	4	1	14	–	–	0,77	**KR 62 PPA**
	29	24	80	49,5	11	0,8	44	M 24×1,5	25	–	4	1	14	–	–	0,80	KRV 62 PPB
	29	24	80	49,5	11	0,8	44	M 24×1,5	25	–	4	1	14	–	–	0,79	**KRV 62 PPA**
	28	24	80	49,5	11	1,3	38	M 24×1,5	25	–	4	1	14	–	–	0,80	**NUKR 62 A**
	28	24	80	49,5	11	1,3	38	M 24×1,5	25	–	4	1	14	–	–	0,80	**PWKR 62.2RS**
	29	28	80	49,5	–	0,8	44	M 24×1,5	25	–	–	1	14	1	22	0,82	KRE 62 PPB
	29	28	80	49,5	–	0,8	44	M 24×1,5	25	–	–	1	14	1	22	0,80	**KRE 62 PPA**
	28	28	80	49,5	–	1,3	38	M 24×1,5	25	–	–	1	14	1	22	0,82	**NUKRE 62 A**
	28	28	80	49,5	–	1,3	38	M 24×1,5	25	–	–	1	14	1	22	0,82	**PWKRE 62.2RS**

[1] All cam followers of the KR design where the designation is printed in grey are gradually being replaced by more robust designs



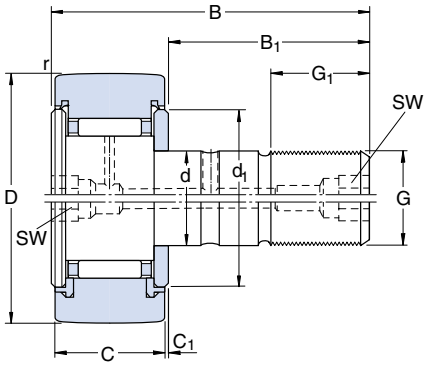
Series NUKR



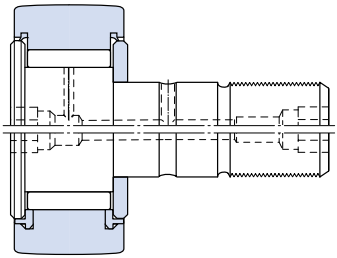
Series PWKRE.2RS

Designation[1]	Basic load ratings dynamic C	static C_0	Fatigue load limit P_u	Maximum radial forces dynamic F_r	static F_{0r}	Speed rating
–	N		N	N		r/min
KR 47 PP	14 700	24 500	2 900	23 600	33 500	2 400
KR 47 PPA	14 700	24 500	2 900	23 600	33 500	2 400
KRV 47 PP	19 400	41 500	5 000	30 500	43 000	1 400
KRV 47 PPA	19 400	41 500	5 000	30 500	43 000	1 400
NUKR 47 A	28 600	33 500	3 900	17 600	25 000	4 200
PWKR 47.2RS	22 900	24 500	2 800	18 300	26 000	3 800
KRE 47 PP	14 700	24 500	2 900	23 600	33 500	2 400
KRE 47 PPA	14 700	24 500	2 900	23 600	33 500	2 400
NUKRE 47 A	28 600	33 500	3 900	17 600	25 000	4 200
PWKRE 47.2RS	22 900	24 500	2 800	18 300	26 000	3 800
KR 52 PP	15 700	27 000	3 200	36 000	51 000	2 400
KR 52 PPA	15 700	27 000	3 200	36 000	51 000	2 400
KRV 52 PP	20 900	46 500	5 600	45 000	64 000	1 300
KRV 52 PPA	20 900	46 500	5 600	45 000	64 000	1 300
NUKR 52 A	29 700	36 000	4 250	18 000	25 500	4 200
PWKR 52.2RS	23 800	26 500	3 050	18 600	26 500	2 800
KRE 52 PP	15 700	27 000	3 200	36 000	51 000	2 400
KRE 52 PPA	15 700	27 000	3 200	36 000	51 000	2 400
NUKRE 52 A	29 700	36 000	4 250	18 000	25 500	4 200
PWKRE 52.2RS	23 800	26 500	3 050	18 600	26 500	2 800
KR 62 PPB	24 600	44 000	5 500	58 500	85 000	1 900
KR 62 PPA	24 600	44 000	5 500	58 500	85 000	1 900
KRV 62 PPB	31 400	72 000	9 000	72 000	102 000	1 100
KRV 62 PPA	31 400	72 000	9 000	72 000	102 000	1 100
NUKR 62 A	41 300	48 000	5 850	25 000	36 000	2 600
PWKR 62.2RS	31 900	32 500	4 050	20 400	29 000	2 200
KRE 62 PPB	24 600	44 000	5 500	58 500	85 000	1 900
KRE 62 PPA	24 600	44 000	5 500	58 500	85 000	1 900
NUKRE 62 A	41 300	48 000	5 850	25 000	36 000	2 600
PWKRE 62.2RS	31 900	32 500	4 050	20 400	29 000	2 200

[1] All cam followers of the KR design where the designation is printed in grey are gradually being replaced by more robust designs



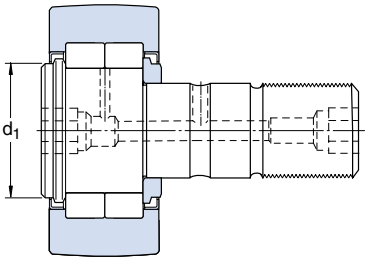
Series KR .. PPB
Series KR .. PPA



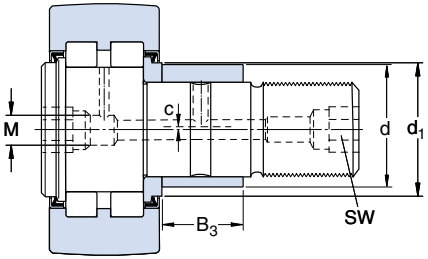
Series KRV .. PPB
Series KRV .. PPA

Dimensions Cam follower													Eccentric collar		Mass	Designation[1]
D	C	d	B	B_1	B_2	C_1	d_1	G	G_1	M_1	r min	SW	c	B_3		
mm															kg	–
72	29	24	80	49,5	11	0,8	44	M 24×1,5	25	4	1,1	14	–	–	1,01	KR 72 PPB
	29	24	80	49,5	11	0,8	44	M 24×1,5	25	4	1,1	14	–	–	1,05	**KR 72 PPA**
	29	24	80	49,5	11	0,8	44	M 24×1,5	25	4	1,1	14	–	–	1,05	KRV 72 PPB
	29	24	80	49,5	11	0,8	44	M 24×1,5	25	4	1,1	14	–	–	1,03	**KRV 72 PPA**
	28	24	80	49,5	11	1,3	44	M 24×1,5	25	4	1,1	14	–	–	1,02	**NUKR 72 A**
	28	24	80	49,5	11	1,3	44	M 24×1,5	25	4	1,1	14	–	–	1,02	**PWKR 72.2RS**
	29	28	80	49,5	–	0,8	44	M 24×1,5	25	–	1,1	14	1	22	1,04	KRE 72 PPB
	29	28	80	49,5	–	0,8	44	M 24×1,5	25	–	1,1	14	1	22	1,04	**KRE 72 PPA**
	28	28	80	49,5	–	1,3	44	M 24×1,5	25	–	1,1	14	1	22	1,05	**NUKRE 72 A**
	28	28	80	49,5	–	1,3	44	M 24×1,5	25	–	1,1	14	1	22	1,05	**PWKRE 72.2RS**
80	35	30	100	63	15	1	53	M 30×1,5	32	4	1,1	14	–	–	1,55	KR 80 PPB
	35	30	100	63	15	1	53	M 30×1,5	32	4	1,1	14	–	–	1,61	**KR 80 PPA**
	35	30	100	63	15	1	53	M 30×1,5	32	4	1,1	14	–	–	1,55	KRV 80 PPB
	35	30	100	63	15	1	53	M 30×1,5	32	4	1,1	14	–	–	1,64	**KRV 80 PPA**
	35	30	100	63	15	1	47	M 30×1,5	32	4	1,1	14	–	–	1,60	**NUKR 80 A**
	35	30	100	63	15	1	47	M 30×1,5	32	4	1,1	14	–	–	1,60	**PWKR 80.2RS**
	35	35	100	63	–	1	53	M 30×1,5	32	–	1,1	14	1,5	29	1,67	KRE 80 PPB
	35	35	100	63	–	1	53	M 30×1,5	32	–	1,1	14	1,5	29	1,67	**KRE 80 PPA**
	35	35	100	63	–	1	47	M 30×1,5	32	–	1,1	14	1,5	29	1,67	**NUKRE 80 A**
	35	35	100	63	–	1	47	M 30×1,5	32	–	1,1	14	1,5	29	1,67	**PWKRE 80.2RS**
90	35	30	100	63	15	1	53	M 30×1,5	32	4	1,1	14	–	–	1,95	KR 90 PPB
	35	30	100	63	15	1	53	M 30×1,5	32	4	1,1	14	–	–	1,98	**KR 90 PPA**
	35	30	100	63	15	1	53	M 30×1,5	32	4	1,1	14	–	–	1,95	KRV 90 PPB
	35	30	100	63	15	1	53	M 30×1,5	32	4	1,1	14	–	–	2,00	**KRV 90 PPA**
	35	30	100	63	15	1	47	M 30×1,5	32	4	1,1	14	–	–	1,96	**NUKR 90 A**
	35	30	100	63	15	1	47	M 30×1,5	32	4	1,1	14	–	–	1,96	**PWKR 90.2RS**
	35	35	100	63	–	1	53	M 30×1,5	32	–	1,1	14	1,5	29	2,03	KRE 90 PPB
	35	35	100	63	–	1	53	M 30×1,5	32	–	1,1	14	1,5	29	2,03	**KRE 90 PPA**
	35	35	100	63	–	1	47	M 30×1,5	32	–	1,1	14	1,5	29	2,02	**NUKRE 90 A**
	35	35	100	63	–	1	47	M 30×1,5	32	–	1,5	14	1,5	29	2,02	**PWKRE 90.2RS**

[1] All cam followers of the KR design where the designation is printed in grey are gradually being replaced by more robust designs



Series NUKR



Series PWKRE.2RS

Designation[1]	Basic load ratings dynamic C	static C_0	Fatigue load limit P_u	Maximum radial forces dynamic F_r	static F_{0r}	Speed rating
–	N		N	N		r/min
KR 72 PPB	26 000	48 000	6 000	100 000	143 000	1 900
KR 72 PPA	26 000	48 000	6 000	100 000	143 000	1 900
KRV 72 PPB	33 000	80 000	9 800	118 000	170 000	1 100
KRV 72 PPA	33 000	80 000	9 800	118 000	170 000	1 100
NUKR 72 A	45 700	58 500	7 100	34 500	50 000	2 600
PWKR 72.2RS	39 600	45 000	5 600	47 500	68 000	2 200
KRE 72 PPB	26 000	48 000	6 000	100 000	143 000	1 900
KRE 72 PPA	26 000	48 000	6 000	100 000	143 000	1 900
NUKRE 72 A	45 700	58 500	7 100	34 500	50 000	2 600
PWKRE 72.2RS	39 600	45 000	5 600	47 500	68 000	2 200
KR 80 PPB	36 900	72 000	9 000	106 000	150 000	1 300
KR 80 PPA	36 900	72 000	9 000	106 000	150 000	1 300
KRV 80 PPB	45 700	114 000	14 000	122 000	176 000	850
KRV 80 PPA	45 700	114 000	14 000	122 000	176 000	850
NUKR 80 A	69 300	86 500	10 800	48 000	69 500	1 800
PWKR 80.2RS	57 200	73 500	9 300	64 000	91 500	1 800
KRE 80 PPB	36 900	72 000	9 000	106 000	150 000	1 300
KRE 80 PPA	36 900	72 000	9 000	106 000	150 000	1 300
NUKRE 80 A	69 300	86 500	10 800	48 000	69 500	1 800
PWKRE 80.2RS	57 200	73 500	9 300	64 000	91 500	1 800
KR 90 PPB	38 000	76 500	9 500	160 000	228 000	1 300
KR 90 PPA	38 000	76 500	9 500	160 000	228 000	1 300
KRV 90 PPB	47 300	122 000	15 000	183 000	260 000	850
KRV 90 PPA	47 300	122 000	15 000	183 000	260 000	850
NUKR 90 A	78 100	102 000	12 700	86 500	125 000	1 800
PWKR 90.2RS	62 700	85 000	10 800	108 000	153 000	1 800
KRE 90 PPB	38 000	76 500	9 500	160 000	228 000	1 300
KRE 90 PPA	38 000	76 500	9 500	160 000	228 000	1 300
NUKRE 90 A	78 100	102 000	12 700	86 500	125 000	1 800
PWKRE 90.2RS	62 700	85 000	10 800	108 000	153 000	1 800

[1] All cam followers of the KR design where the designation is printed in grey are gradually being replaced by more robust designs


SKF

Components and accessories

Inner rings ..... **page 204**
Needle rollers ..... **page 211**
Seals ..... **page 214**

Inner rings

Product tables ..... **page 207**

SKF also supplies loose inner rings for needle roller bearings. Their use is particularly advantageous where needle roller and cage assemblies and drawn cup needle roller bearings are used, but where the shaft cannot be hardened and ground, i.e. raceways cannot be machined in the shaft. It has often been found beneficial to combine needle roller bearings with extended inner rings in order to permit larger axial displacements of the shaft relative to the housing than is possible with the standard-width rings, or to provide an ideal counterface for the lips of rubbing seals.

Three designs of needle roller bearing inner rings can be supplied by SKF:

- inner rings, series IR
- inner rings, series IRZ
- inner rings, series LR

Inner rings, series IR

Inner rings of series IR (➔ **fig** 1) are the standard SKF inner rings for needle roller bearings. They are made of carbon chromium steel and are hardened and ground. To facilitate their combination with needle roller and cage assemblies or the outer ring assembly of needle roller bearings, they have a lead-in at each side of the raceway.

Some sizes of IR inner rings have a lubrication hole (➔ **fig** 2). Such inner rings are identified by the designation suffix IS1.

Tolerances

The bore diameter and width of the IR inner rings are made to Normal tolerances in accordance with ISO 492:1994 (➔ **Table** 2, **page17**). The raceway diameter F tolerances have been chosen to give a normal radial internal clearance if the recommended shaft and housing tolerances are applied.

Fig 1

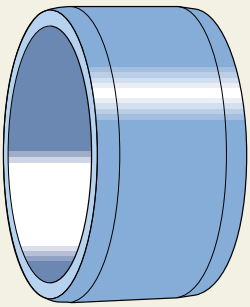
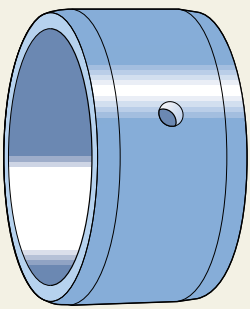


Fig 2



Inner ring seatings

The seatings for needle roller bearings on the shaft should be according to the following recommendations.

Shaft diameter tolerances

When inner rings are used under conditions of point load they may be mounted with a loose fit. In such cases the seatings should be machined to tolerance h6 or g6.

When the load rotates, the inner rings should have an interference fit. Sufficient interference will be obtained if the shaft tolerances given in **Table** 1 are used.

Cylindricity

The cylindricity to ISO 1101-1985 should be as follows:

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

Runout

The abutments for the inner rings on the shaft should have a runout corresponding to IT4.

Inner rings, series IRZ

The inner rings of series IRZ (➔ **fig** 3) are made of carbon chromium steel, and are hardened and ground. The raceway of these inner rings covers the whole ring width. For this reason, the use of IRZ inner rings is preferred where axial space is limited at the same time as relatively large axial displacements of the shaft have to be accommodated, or where counterfaces are required for seals.

All inner rings of series IRZ have one lubrication hole and carry the designation suffix IS1 to indicate this.

Tolerances

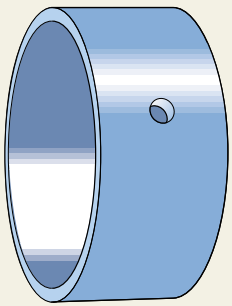
The bore diameter and width tolerances for IRZ inner rings are in accordance with the Normal tolerances specified in ISO 492:1994 (➔ **Table** 2, **page 17**). The tolerances for the raceway diameter F have been chosen to give a normal radial internal clearance in the bearing, if the recommended shaft and housing seating tolerances are applied (➔ “Inner ring seatings”).

Table 1

Recommended shaft diameter tolerances

Shaft diameter d		ISO tolerance
over	incl.	
mm		–
–	**50**	k6
50	**120**	m6
120	**250**	n6

Fig 3



Inner rings, series LR

LR inner rings (➔ **fig** 4) are made of carbon chromium steel and hardened. The bore and outside diameters are ground. The side faces are not ground and the edges are only smoothed. For applications where the larger width and runout tolerances are unimportant, LR inner rings offer an economic solution. They are, therefore, often used in combination with drawn cup needle roller bearings or needle roller and cage assemblies.

Tolerances

The bore diameter of LR inner rings is made to tolerance K6, the raceway diameter to h6 and the width to h12.

The values for the deviation from the nominal dimension for the tolerances mentioned above are given in **Table** 2.

Fig 4

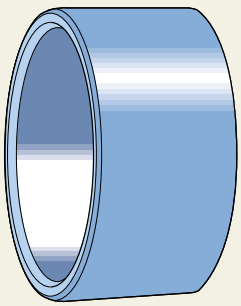
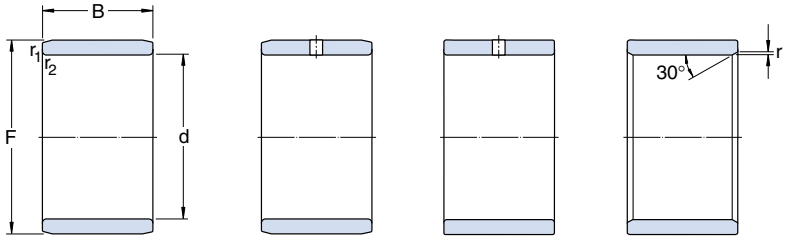


Table 2

ISO tolerances

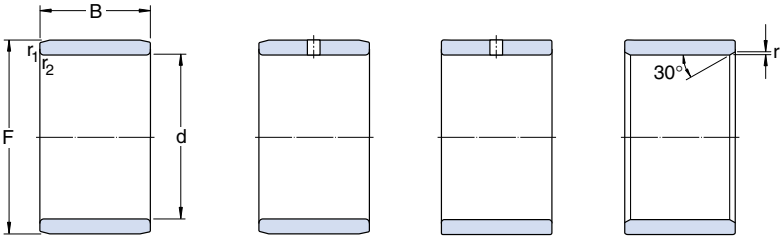
Nominal dimension over	incl.	**h6** Deviations high	low	**h12** Deviations high	low	**K6** Deviations high	low
mm		µm		µm		µm	
6	**10**	0	–9	0	–150	+2	–7
10	**18**	0	–11	0	–180	+2	–9
18	**30**	0	–13	0	–210	+2	–11
30	**50**	0	–16	0	–250	+3	–13
50	**80**	0	–19	0	–300	+4	–15



Series IR | Series IR .. IS1 | Series IRZ .. IS1 | Series LR

Dimensions				Mass	Designation
d	F	B	r, $r_{1,2}$ min		
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**
	10	12	0,3	0,0046	**IRZ 6×10×12 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	0,0050	**IR 8×12×10.5**
	12	10,5	0,3	0,0050	**LR 8×12×10.5**
	12	12	0,3	0,0057	**IRZ 8×12×12 IS1**
	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	14	0,3	0,0080	**IRZ 10×14×14 IS1**
	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	0,0080	**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**

Dimensions				Mass	Designation
d	F	B	r, $r_{1,2}$ min		
mm				kg	–
12	16	12	0,3	0,0079	**IR 12×16×12 IS1**
	16	13	0,3	0,0087	**IR 12×16×13**
	16	14	0,3	0,0095	**IRZ 12×16×14 IS1**
	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	0,010	**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	14	0,3	0,015	**IRZ 15×20×14 IS1**
	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	14	0,3	0,016	**IRZ 17×22×14 IS1**
	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**



Series IR | Series IR .. IS1 | Series IRZ .. IS1 | Series LR

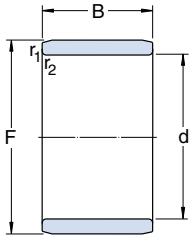
Dimensions				Mass	Designation
d	F	B	r, $r_{1,2}$ min		
mm				kg	–
20	24	16	0,3	0,017	**IR 20×24×16**
	24	20	0,3	0,021	**IR 20×24×20**
	25	12,5	0,3	0,016	**LR 20×25×12.5**
	25	16	0,3	0,021	**IR 20×25×16 IS1**
	25	16,5	0,3	0,022	**LR 20×25×16.5**
	25	17	0,3	0,022	**IR 20×25×17**
	25	18	0,3	0,024	**IRZ 20×25×18 IS1**
	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**
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	0,030	**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	0,020	**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	18	0,3	0,030	**IRZ 25×30×18 IS1**
	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	0,050	**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**

Dimensions				Mass	Designation
d	F	B	r, $r_{1,2}$ min		
mm				kg	–
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	18	0,3	0,035	**IRZ 30×35×18 IS1**
	35	20	0,3	0,040	**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	0,050	**IR 30×35×26**
	35	30	0,3	0,059	**IR 30×35×30**
	37	18	0,6	0,050	**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**
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	21	0,6	0,068	**IRZ 35×42×21 IS1**
	42	23	0,6	0,074	**IRZ 35×42×23 IS1**
	42	36	0,6	0,12	**IR 35×42×36**
	43	22	0,6	0,082	**IR 35×43×22**

Dimensions				Mass	Designation
d	F	B	r, $r_{1,2}$ min		
mm				kg	–
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	23	0,6	0,097	**IRZ 40×48×23 IS1**
	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**
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	0,10	**IR 45×50×35**
	52	22	0,6	0,089	**IR 45×52×22**
	52	23	0,6	0,093	**IRZ 45×52×23 IS1**
	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	23	0,6	0,12	**IRZ 50×58×23 IS1**
	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**

Dimensions				Mass	Designation
d	F	B	r, $r_{1,2}$ min		
mm				kg	–
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	0,20	**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	0,20	**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**
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	0,30	**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**

Inner rings
d **90 – 380** mm



Dimensions				Mass	Designation
d	F	B	$r_{1,2}$ min		
mm				kg	–
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	1,10	**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	1,00	**IR 120×135×45**
130	145	35	1,1	0,86	**IR 130×145×35**
	150	50	1,5	1,70	**IR 130×150×50**
140	155	35	1,1	0,92	**IR 140×155×35**
	160	50	1,5	1,80	**IR 140×160×50**
150	165	40	1,1	1,10	**IR 150×165×40**
160	175	40	1,1	1,20	**IR 160×175×40**
170	185	45	1,1	1,45	**IR 170×185×45**
180	195	45	1,1	1,50	**IR 180×195×45**
190	210	50	1,5	2,40	**IR 190×210×50**
200	220	50	1,5	2,50	**IR 200×220×50**
220	240	50	1,5	2,75	**IR 220×240×50**
240	265	60	2	4,60	**IR 240×265×60**
260	285	60	2	5,00	**IR 260×285×60**
280	305	69	2	6,10	**IR 280×305×69**
300	330	80	2,1	9,20	**IR 300×330×80**
320	350	80	2,1	9,80	**IR 320×350×80**
340	370	80	2,1	10,0	**IR 340×370×80**
360	390	80	2,1	11,0	**IR 360×390×80**
380	415	100	2,1	17,0	**IR 380×415×100**

Needle rollers

Product tables ..... **page 212**

SKF also supplies loose needle rollers. They can be used to produce full complement bearing arrangements for slow speed or oscillating operation which can carry heavy loads and are economic provided shaft and housing bore can serve as raceways. These should have the same quality and hardness as the rings of needle roller bearings. SKF needle rollers conform to ISO 3096:1996 for rollers with flat ends (B design). They are made from carbon chromium (bearing steel) and have a hardness of 58 to 65 HRC. The cylindrical surface of the rollers is slightly relieved towards the roller ends in order to avoid damaging edge stresses.

SKF supplies grade G2 needle rollers (ISO 6193-1980) with the dimensional and form tolerances shown in **Table 1**. The rollers are gauged according to their deviations from the nominal diameter. Needle rollers of each gauge are packed separately and the package is marked with the smallest and largest diameter deviations, e.g. N/M2 or M2/M4. M signifies minus and N zero. For a 2 mm nominal diameter needle roller with the deviations M2/M4, the actual diameter will lie between 1,996 and 1,998 mm. For bearing arrangements it is recommended to use needle rollers of the same gauge.

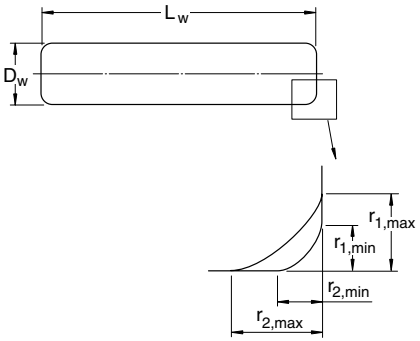
A consignment of needle rollers of the same nominal diameter may contain packages of one or more gauges depending on availability at the time.

Table 1

Dimensional and form accuracy of needle rollers of grade G2

Diameter D_w Deviation		Gauge tolerance	Gauge limits	Circularity tolerance to ISO 1101	**Length L_w** Tolerance
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

Needle rollers
D_w **1 – 6** mm



Dimensions					Mass per 100	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**
1,5	5,8	0,1	0,4	0,6	0,081	**RN-1.5×5.8 BF**
	6,8	0,1	0,4	0,6	0,094	**RN-1.5×6.8 BF**
	7,8	0,1	0,4	0,6	0,108	**RN-1.5×7.8 BF**
	9,8	0,1	0,4	0,6	0,136	**RN-1.5×9.8 BF**
	11,8	0,1	0,4	0,6	0,164	**RN-1.5×11.8 BF**
	13,8	0,1	0,4	0,6	0,191	**RN-1.5×13.8 BF**
2	6,3	0,2	0,6	0,8	0,16	**RN-2×6.3 BF**
	7,8	0,2	0,6	0,8	0,19	**RN-2×7.8 BF**
	9,8	0,2	0,6	0,8	0,24	**RN-2×9.8 BF**
	11,8	0,2	0,6	0,8	0,29	**RN-2×11.8 BF**
	13,8	0,2	0,6	0,8	0,34	**RN-2×13.8 BF**
	15,8	0,2	0,6	0,8	0,39	**RN-2×15.8 BF**
	17,8	0,2	0,6	0,8	0,44	**RN-2×17.8 BF**
	19,8	0,2	0,6	0,8	0,49	**RN-2×19.8 BF**
	21,8	0,2	0,6	0,8	0,54	**RN-2×21.8 BF**
2,5	7,8	0,2	0,6	0,8	0,30	**RN-2.5×7.8 BF**
	9,8	0,2	0,6	0,8	0,38	**RN-2.5×9.8 BF**
	11,8	0,2	0,6	0,8	0,45	**RN-2.5×11.8 BF**
	13,8	0,2	0,6	0,8	0,53	**RN-2.5×13.8 BF**
	15,8	0,2	0,6	0,8	0,61	**RN-2.5×15.8 BF**
	17,8	0,2	0,6	0,8	0,69	**RN-2.5×17.8 BF**
	19,8	0,2	0,6	0,8	0,76	**RN-2.5×19.8 BF**
	21,8	0,2	0,6	0,8	0,84	**RN-2.5×21.8 BF**
	23,8	0,2	0,6	0,8	0,92	**RN-2.5×23.8 BF**
3	9,8	0,2	0,6	0,8	0,54	**RN-3×9.8 BF**
	11,8	0,2	0,6	0,8	0,65	**RN-3×11.8 BF**
	13,8	0,2	0,6	0,8	0,77	**RN-3×13.8 BF**
	15,8	0,2	0,6	0,8	0,88	**RN-3×15.8 BF**
	17,8	0,2	0,6	0,8	0,99	**RN-3×17.8 BF**
	19,8	0,2	0,6	0,8	1,10	**RN-3×19.8 BF**
	21,8	0,2	0,6	0,8	1,21	**RN-3×21.8 BF**
	23,8	0,2	0,6	0,8	1,32	**RN-3×23.8 BF**

Dimensions					Mass per 100	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	0,89	**RN-3.5×11.8 BF**
	13,8	0,3	0,8	1,0	1,04	**RN-3.5×13.8 BF**
	15,8	0,3	0,8	1,0	1,19	**RN-3.5×15.8 BF**
	17,8	0,3	0,8	1,0	1,34	**RN-3.5×17.8 BF**
	19,8	0,3	0,8	1,0	1,50	**RN-3.5×19.8 BF**
	21,8	0,3	0,8	1,0	1,65	**RN-3.5×21.8 BF**
	29,8	0,3	0,8	1,0	2,25	**RN-3.5×29.8 BF**
	34,8	0,3	0,8	1,0	2,63	**RN-3.5×34.8 BF**
4	11,8	0,3	0,8	1,0	1,16	**RN-4×11.8 BF**
	13,8	0,3	0,8	1,0	1,36	**RN-4×13.8 BF**
	15,8	0,3	0,8	1,0	1,56	**RN-4×15.8 BF**
	17,8	0,3	0,8	1,0	1,76	**RN-4×17.8 BF**
	19,8	0,3	0,8	1,0	1,95	**RN-4×19.8 BF**
	21,8	0,3	0,8	1,0	2,15	**RN-4×21.8 BF**
	23,8	0,3	0,8	1,0	2,35	**RN-4×23.8 BF**
	25,8	0,3	0,8	1,0	2,55	**RN-4×25.8 BF**
	27,8	0,3	0,8	1,0	2,74	**RN-4×27.8 BF**
	29,8	0,3	0,8	1,0	2,94	**RN-4×29.8 BF**
	34,8	0,3	0,8	1,0	3,43	**RN-4×34.8 BF**
	39,8	0,3	0,8	1,0	3,93	**RN-4×39.8 BF**
5	15,8	0,3	0,8	1,0	2,44	**RN-5×15.8 BF**
	19,8	0,3	0,8	1,0	3,05	**RN-5×19.8 BF**
	21,8	0,3	0,8	1,0	3,36	**RN-5×21.8 BF**
	23,8	0,3	0,8	1,0	3,67	**RN-5×23.8 BF**
	25,8	0,3	0,8	1,0	3,98	**RN-5×25.8 BF**
	27,8	0,3	0,8	1,0	4,28	**RN-5×27.8 BF**
	29,8	0,3	0,8	1,0	4,59	**RN-5×29.8 BF**
	34,8	0,3	0,8	1,0	5,36	**RN-5×34.8 BF**
	39,8	0,3	0,8	1,0	6,13	**RN-5×39.8 BF**
6	17,8	0,3	0,8	1,0	3,95	**RN-6×17.8 BF**

Seals

Product tables ..... **page 216**

It is not always easy to find commercially available radial shaft seals for bearing arrangements incorporating needle roller bearings because of the very low cross section of these bearings. SKF supplies a range of special low cross section radial shaft seals for such bearing arrangements; the sealing lip is not spring loaded.

Two designs are available: the G design and the SD design. The latter has a secondary dust lip in addition to the primary sealing lip, and is used to retain lubricant in the bearing arrangement while excluding dust and other contaminants.

Radial shaft seals of G design

The G-design radial shaft seals are made of nitrile rubber (NBR) and are reinforced with sheet steel. Except for the smallest seals for shaft diameters up to and including 7 mm (→ **fig** 1) the steel reinforcement is completely embedded in the rubber (→ **fig** 2). The rubber outside diameter provides reliable sealing between the seal and the housing bore.

If the seal is to be used primarily for lubricant retention it should be mounted with the lip pointing inwards; if the primary purpose is to exclude contaminants, the lip should point outwards, away from the bearing.

Radial shaft seals of SD design

The SD-design radial shaft seals (→ **fig** 3) have a primary sealing lip without garter spring and an additional rubbing lip. The seals are made of polyurethane elastomer reinforced with a ring of polyamide.

The primary sealing lip, i.e. the larger of the two lips, should always point towards the medium which is to be sealed. Thus if protection is required against contaminants, the lip should face outwards; the secondary (smaller) lip will retain lubricant in the bearing arrangement. The space between the

Fig 1

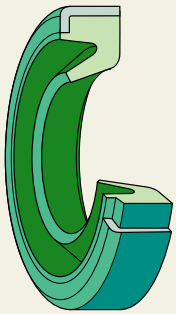
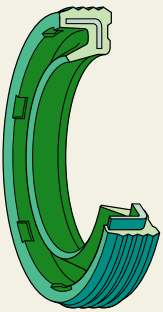


Fig 2



two lips should be filled with grease which will provide additional protection.

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

Design of associated components

The housing bore tolerances normally recommended for needle roller bearings, for example, will give a sufficient interference fit to the seals, and no additional axial location will be needed. To simplify mounting, the bore should have a 5 to 10° lead-in (DIN 3760:1966). The riding surface of the sealing lips on the shaft should be hardened and ground. The surface roughness R_a should lie between 0,2 and 0,8 µm (R_z between 1 and 4 µm) if the maximum permissible peripheral speeds are to be used.

The shaft ends should also have a lead-in to DIN 3760:1966, to prevent dishing of the sealing lips during mounting.

Speeds

The permissible rotational speeds depend on the diameter of the counterface and the permissible maximum circumferential speeds. These are

– 10 m/s for G seals, and
– 7 m/s for SD seals,

provided that the recommendations given under “Design of associated components” are adhered to.

Operating temperature range

The permissible operating temperature range for G-design seals is –40 to +120 °C, and for SD-design seals it is –20 to +100 °C.

Mounting

The seals should be mounted so that they are concentric with the shaft and perpendicular to it. The use of a suitable mounting tool (➔ **fig** 4) 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 (➔ **fig** 4) should be used to prevent damage to the seal.

Fig 3

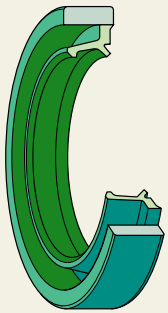
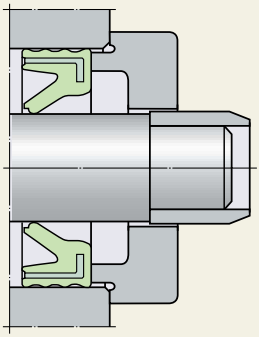
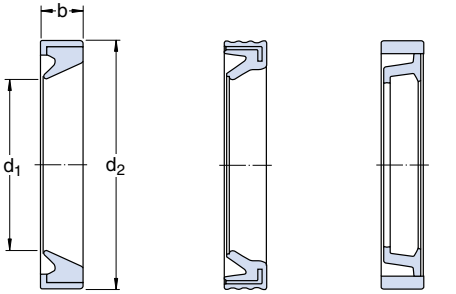


Fig 4



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



Series G
$d_1 \leq 7$ mm

Series G
$d_1 \geq 8$ mm

Series SD

Dimensions			Mass per 100	Designation
d_1	d_2	b		
mm			kg	–
4	8	2	0,018	**G 4×8×2**
5	9	2	0,019	**G 5×9×2**
	10	2	0,022	**G 5×10×2**
6	10	2	0,021	**G 6×10×2**
	12	2	0,038	**G 6×12×2**
7	11	2	0,025	**G 7×11×2**
	14	2	0,052	**G 7×14×2**
8	12	3	0,041	**G 8×12×3**
	15	3	0,065	**G 8×15×3**
	15	3	0,040	**SD 8×15×3**
9	13	3	0,044	**G 9×13×3**
	16	3	0,069	**G 9×16×3**
10	14	3	0,050	**G 10×14×3**
	17	3	0,090	**G 10×17×3**
	17	3	0,044	**SD 10×17×3**
12	16	3	0,060	**G 12×16×3**
	18	3	0,090	**G 12×18×3**
	18	3	0,050	**SD 12×18×3**
	19	3	0,10	**G 12×19×3**
	19	3	0,060	**SD 12×19×3**
13	19	3	0,090	**G 13×19×3**
14	20	3	0,10	**G 14×20×3**
	20	3	0,050	**SD 14×20×3**
	21	3	0,11	**G 14×21×3**
	22	3	0,13	**G 14×22×3**
	22	3	0,070	**SD 14×22×3**
15	21	3	0,10	**G 15×21×3**
	21	3	0,050	**SD 15×21×3**
	23	3	0,13	**G 15×23×3**
	23	3	0,070	**SD 15×23×3**

Dimensions			Mass per 100	Designation
d_1	d_2	b		
mm			kg	–
16	22	3	0,13	**G 16×22×3**
	22	3	0,060	**SD 16×22×3**
	24	3	0,13	**G 16×24×3**
	24	3	0,080	**SD 16×24×3**
	25	3	0,16	**G 16×25×3**
17	23	3	0,13	**G 17×23×3**
	23	3	0,060	**SD 17×23×3**
	25	3	0,15	**G 17×25×3**
	25	3	0,080	**SD 17×25×3**
18	24	3	0,12	**G 18×24×3**
	24	3	0,060	**SD 18×24×3**
	26	4	0,18	**G 18×26×4**
	26	4	0,11	**SD 18×26×4**
19	27	4	0,20	**G 19×27×4**
	27	4	0,11	**SD 19×27×4**
20	26	4	0,18	**G 20×26×4**
	26	4	0,080	**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	0,090	**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**
	32	4	0,14	**SD 24×32×4**
25	32	4	0,23	**G 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	0,30	**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	0,40	**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	0,30	**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	0,90	**G 70×78×5**


SKF

Product index

The product range shown in this catalogue comprises more than 1 600 bearings, support rollers and cam followers, inner rings and accessories. In order to enable the user to quickly find the technical data for a product known only by its designation, the products are listed by designation in alpha-numerical order in this index. The page on which the product will be found is given as well as a code number to identify the product type. The codes are explained in the following.

1 Needle roller and cage assembly
2 Drawn cup needle roller bearing, with open ends
3 Drawn cup needle roller bearing, with closed end
4 Needle roller bearing with flanges, without inner ring
5 Needle roller bearing with flanges, with inner ring
6 Needle roller bearing without flanges, without inner ring
7 Needle roller bearing without flanges, with inner ring
8 Alignment needle roller bearing, without inner ring
9 Alignment needle roller bearing, with inner ring
10 Needle roller and cage thrust assembly
11 Raceway washer for thrust bearing
12 Thrust washer for thrust bearing
13 Shaft washer for thrust bearing
14 Housing washer for thrust bearing
15 Combined needle roller/angular contact ball bearing
16 Combined needle roller/thrust ball bearing
17 Combined needle roller/cylindrical roller thrust bearing
18 Support roller
19 Cam follower
20 Inner ring
21 Needle roller
22 Seal

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AS 0414	12	125
AS 0515	12	125
AS 0619	12	125
AS 0821	12	125
AS 1024	12	125
AS 1226	12	125
AS 1528	12	125
AS 1730	12	125
AS 2035	12	125
AS 2542	12	125
AS 3047	12	125
AS 3552	12	125
AS 4060	12	125
AS 4565	12	125
AS 5070	12	125
AS 5578	12	125
AS 6085	12	125
AS 6590	12	125
AS 7095	12	125
AS 75100	12	125
AS 80105	12	125
AS 85110	12	127
AS 90120	12	127
AS 100135	12	127
AS 110145	12	127
AS 120155	12	127
AS 130170	12	127
AS 140180	12	127
AS 150190	12	127
AS 160200	12	127
AXK 0414 TN	10	124
AXK 0515 TN	10	124
AXK 0619 TN	10	124
AXK 0821 TN	10	124
AXK 1024	10	124
AXK 1226	10	124
AXK 1528	10	124
AXK 1730	10	124
AXK 2035	10	124
AXK 2542	10	124
AXK 3047	10	124
AXK 3552	10	124
AXK 4060	10	124
AXK 4565	10	124
AXK 5070	10	124
AXK 5578	10	124
AXK 6085	10	124
AXK 6590	10	124
AXK 7095	10	124
AXK 75100	10	124
AXK 80105	10	124
AXK 85110	10	126
AXK 90120	10	126
AXK 100135	10	126
AXK 110145	10	126
AXK 120155	10	126
AXK 130170	10	126
AXK 140180	10	126
AXK 150190	10	126
AXK 160200	10	126
BK 0306 TN	3	56
BK 0408	3	56
BK 0509	3	56
BK 0609	3	56
BK 0709	3	56
BK 0808	3	56
BK 0810	3	56
BK 0910	3	56
BK 0912	3	56
BK 1010	3	56
BK 1012	3	56
BK 1015	3	56
BK 1210	3	58
BK 1212	3	58
BK 1312	3	58

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BK 1414 RS	3	58
BK 1512	3	58
BK 1516	3	58
BK 1612	3	58
BK 1614 RS	3	58
BK 1616	3	58
BK 1622	3	58
BK 1812	3	60
BK 1816	3	60
BK 2016	3	60
BK 2018 RS	3	60
BK 2020	3	60
BK 2212	3	60
BK 2216	3	60
BK 2518 RS	3	60
BK 2520	3	60
BK 2526	3	62
BK 2538	3	62
BK 3012	3	62
BK 3016	3	62
BK 3020	3	62
BK 3026	3	62
BK 3038	3	62
BK 3520	3	62
BK 4020	3	62
BK 4520	3	64
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G 5×9×2	22	216
G 5×10×2	22	216
G 6×10×2	22	216
G 6×12×2	22	216
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G 8×15×3	22	216
G 9×13×3	22	216
G 9×16×3	22	216
G 10×14×3	22	216
G 10×17×3	22	216
G 12×16×3	22	216
G 12×18×3	22	216
G 12×19×3	22	216
G 13×19×3	22	216
G 14×20×3	22	216
G 14×21×3	22	216
G 14×22×3	22	216
G 15×21×3	22	216
G 15×23×3	22	216
G 16×22×3	22	216
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G 20×26×4	22	216
G 20×28×4	22	216
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G 25×35×4	22	216
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G 28×35×4	22	217
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G 40×50×4	22	217
G 40×52×5	22	217
G 42×52×4	22	217
G 43×53×4	22	217
G 45×52×4	22	217
G 45×55×4	22	217
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G 50×62×5	22	217
G 55×63×5	22	217
G 70×78×5	22	213
GS 81102	14	125
GS 81103	14	125
GS 81104	14	125
GS 81105	14	125
GS 81106	14	125
GS 81107	14	125
GS 81108	14	125
GS 81109	14	125
GS 81110	14	125
GS 81111	14	125
GS 81112	14	125
GS 81113	14	125
GS 81114	14	125
GS 81115	14	125
GS 81116	14	125
GS 81117	14	127
GS 81118	14	127
GS 81120	14	127
GS 81122	14	127
GS 81124	14	127
GS 81126	14	127
GS 81128	14	127
GS 81130	14	127
GS 81132	14	127
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HK 0408	2	56
HK 0509	2	56
HK 0608	2	56
HK 0609	2	56
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HK 0810	2	56
HK 0810 RS	2	56
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HK 1416.2RS	2	58
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HK 1518 RS	2	58
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HK 2016.2RS	2	60
HK 2018 RS	2	60
HK 2020	2	60
HK 2020.2RS	2	60
HK 2030	2	60
HK 2210	2	60
HK 2212	2	60
HK 2214 RS	2	60
HK 2216	2	60
HK 2216.2RS	2	60
HK 2218 RS	2	60
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HK 2220.2RS	2	60
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HK 2516.2RS	2	60
HK 2518 RS	2	60
HK 2520	2	60
HK 2520.2RS	2	60
HK 2524.2RS	2	60
HK 2526	2	60
HK 2530.2RS	2	62
HK 2538	2	62
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HK 2820.2RS	2	62
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HK 3016	2	62
HK 3016.2RS	2	62
HK 3018 RS	2	62
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HK 3020.2RS	2	62
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HK 5024.2RS	2	64
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IR 55×63×25	20	209
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IR 60×68×45	20	209
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IR 75×85×25	20	209
IR 75×85×30	20	209
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IR 95×105×26	20	210
IR 95×105×36	20	210
IR 95×110×35	20	210
IR 95×110×63	20	210
IR 100×110×30	20	210
IR 100×110×40	20	210
IR 100×115×40	20	210
IR 110×120×30	20	210
IR 110×125×40	20	210
IR 120×130×30	20	210
IR 120×135×45	20	210
IR 130×145×35	20	210
IR 130×150×50	20	210
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IR 140×160×50	20	210
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IR 180×195×45	20	210
IR 190×210×50	20	210
IR 200×220×50	20	210
IR 220×240×50	20	210
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K 3×5×9 TN	1	40
K 3×6×7 TN	1	40
K 4×7×7 TN	1	40
K 4×7×10 TN	1	40
K 5×8×8 TN	1	40
K 5×8×10 TN	1	40
K 6×9×8 TN	1	40
K 6×9×10 TN	1	40
K 6×10×13 TN	1	40
K 7×9×7 TN	1	40
K 7×10×8 TN	1	40
K 7×10×10 TN	1	40
K 8×11×8 TN	1	40
K 8×11×10 TN	1	40
K 8×11×13 TN	1	40
K 8×12×10 TN	1	40
K 9×12×10 TN	1	40
K 9×12×13 TN	1	40
K 10×13×10 TN	1	40
K 10×13×13 TN	1	40
K 10×13×16 TN	1	40
K 10×14×10 TN	1	40
K 10×14×13 TN	1	40

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K 12×15×13 TN	1	40
K 12×16×13 TN	1	40
K 12×17×13 TN	1	40
K 12×18×12 TN	1	40
K 14×18×10	1	41
K 14×18×13	1	41
K 14×18×17	1	41
K 14×20×12	1	41
K 15×18×17 TN	1	41
K 15×19×10	1	41
K 15×19×13	1	41
K 15×19×17	1	41
K 15×20×13	1	41
K 15×21×15	1	41
K 15×21×21	1	41
K 16×20×10	1	41
K 16×20×13	1	41
K 16×20×17	1	41
K 16×22×12	1	41
K 16×22×16	1	41
K 16×22×20	1	41
K 16×24×20	1	41
K 17×21×10	1	41
K 17×21×13	1	41
K 17×21×17	1	41
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K 18×28×16	1	41
K 19×23×13	1	41
K 19×23×17	1	41
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K 20×30×30	1	42
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K 22×26×10	1	42
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K 25×29×13	1	42
K 25×29×17	1	42
K 25×30×17	1	42
K 25×30×20	1	42
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K 25×31×17	1	42
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K 30×35×13	1	43
K 30×35×17	1	43
K 30×35×27	1	43
K 30×37×16	1	43
K 30×37×18	1	43
K 30×40×18	1	43
K 30×40×30	1	43
K 32×37×13	1	43
K 32×37×17	1	43
K 32×37×27	1	43
K 32×38×20	1	43
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K 35×40×27 TN	1	43
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K 35×42×30	1	43
K 35×45×20	1	43
K 37×42×17	1	43
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K 38×46×32	1	44
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K 40×45×13	1	44
K 40×45×17	1	44
K 40×45×27	1	44
K 40×47×18	1	44
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K 60×66×40 ZW	1	45
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KR 19 PPSK	19	192
KR 19 PPSKA	19	192
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KR 22 PP	19	192
KR 22 PPA	19	192

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KR 30	19	194
KR 30 B	19	194
KR 30 PP	19	194
KR 30 PPA	19	194
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KR 32 B	19	194
KR 32 PP	19	194
KR 32 PPA	19	194
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KR 35 B	19	196
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LS 85110	11	127
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