Planetary Gear Bearing Arrangements in Industrial Gearboxes

Technical principles
Products and applications

SCHAEFFLER

Foreword

Industrial gearboxes are being designed as increasingly compact with smaller design envelope while their power levels are continually increasing. This increase in power density within a very small space places increasingly high demands on the rolling bearings used. This is particularly true for planetary gearboxes in industrial gearboxes, since such gearboxes must transmit very high power levels with high operational security within a very small design envelope. In more than a few cases, the planetary gears in particular are subjected to loads up to their physical limits. At the same time, the planet carriers and planet pins are subjected to heavy reversed bending loads.

For this demanding area of application, bearing solutions are only accepted if the bearing arrangements not only have a reduced design envelope and give quiet running but also have low friction, extremely high reliability levels, a very long life and are very easy to fit.

Technical and economic leadership

For applications in planetary gearboxes, Schaeffler has solutions giving major customer benefits, such as:

- radially very compact, full complement single and double row cylindrical roller bearings RSL without an outer ring, with high dynamic and static load carrying capacity
- cage-guided cylindrical roller bearings RN, especially suitable for high speeds
- needle roller and cage assemblies KZK for high centrifugal and acceleration forces, designed for very high speeds
- full complement needle roller arrangements NRB and VRS with very high load carrying capacity while requiring the very smallest radial design envelope.

In addition, there are a large number of special solutions to fulfil a very wide range of requirements.

Advice on the selection of bearings and the design of bearing arrangements in planetary gear bearing arrangements is available from Schaeffler application engineers and the Schaeffler engineering service worldwide.

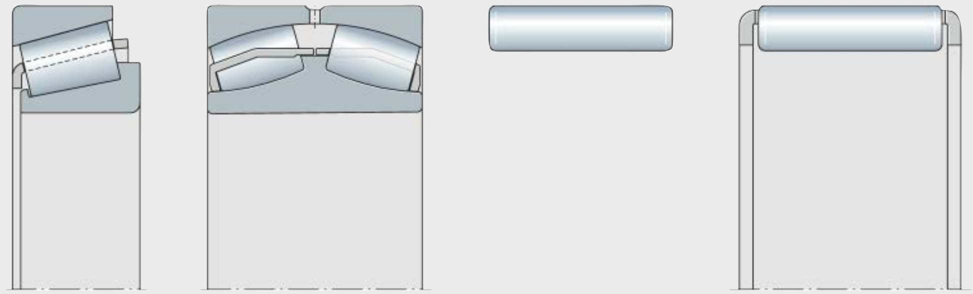
Replacement for...

This Technical Product Information TPI 08, Planetary Gear Bearing Arrangements in Industrial Gearboxes, replaces the previous TPI 08, Rolling Bearings in Large Gearboxes. Any information in previous editions which does not concur with the data in this edition is therefore invalid.

TPI 08 is a supplement to Catalogue HR 1, Rolling Bearings. It essentially covers the subjects relating to planetary gear bearing arrangements in industrial gearboxes that are not described in Catalogue HR 1. In the design of the bearing arrangement, however, the relevant information in Catalogue HR 1 must also be observed.

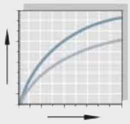
Contents

Product index

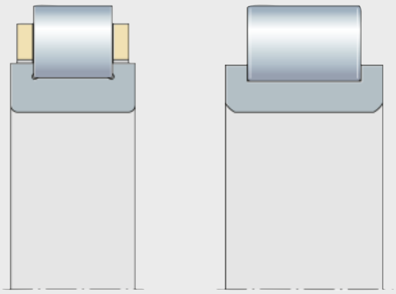


0001771D

00017731



Technical principles



Planetary gear bearings

Full complement
cylindrical roller bearings

Cylindrical roller bearings with cage

Needle roller and cage assemblies

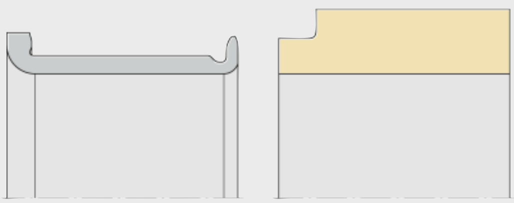
Needle rollers

Full complement
needle roller arrangements

Full complement needle roller sets

Spherical roller bearings

Tapered roller bearings



Special solutions

X-life

Cage design

Cage for high accelerations

Bearing arrangements
with optimised mass

Floating planetary gear
bearing arrangements

Axial location of bearings

Coated bearings

Applications in planetary gearboxes

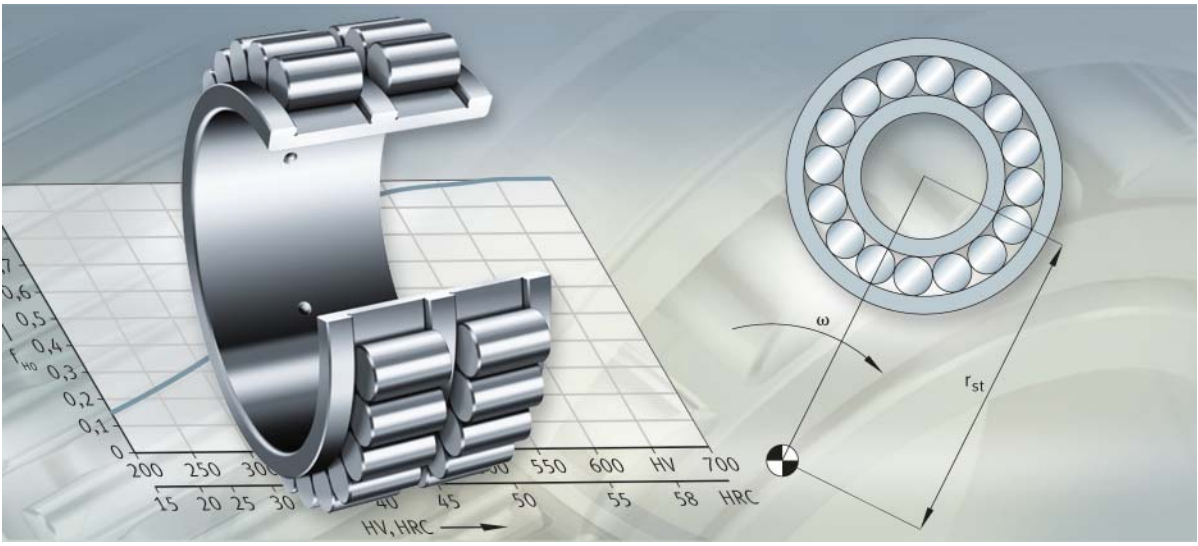
Pitch and yaw gearbox for wind turbines

Hydraulic drive unit

Slewing gear drive
for crawler excavators

Planetary gearbox
with front-mounted spur gear stage

Addresses



Technical principles

Friction
Speeds
Lubrication
Design of bearing arrangements
Design examples

Technical principles

Friction

Frictional components

Catalogue HR 1, Rolling Bearings gives a detailed description, in the chapter Friction and increases in temperature, of the subject of friction and the calculation of frictional torques. The information presented here is supplementary and covers planetary gear bearing arrangements.

The friction in a rolling bearing is made up of several components, see table. Due to the large number of influencing factors, such as dynamics at speed and load, tilting and skewing during mounting, actual frictional torques and frictional energy may deviate significantly from the calculated values.

If the frictional torque is an important design criterion, please consult the Schaeffler engineering service.

Frictional component and influencing factor

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

The idling friction is dependent on the lubricant quantity, speed, operating viscosity of the lubricant and the running-in condition of the bearing.

For planetary gear bearing arrangements in industrial gearboxes, the bearing factors f_0 and f_1 apply, see tables.

Factor f_0, f_1 for needle roller and cage assemblies and full complement needle roller arrangements

Series	Bearing factor f_0		Bearing factor f_1
	Grease, oil mist	Oil bath, recirculating oil	
VRS	$(30 \cdot B)/(33 + d)$	$(45 \cdot B)/(33 + d)$	0,0005
K, KZK	$(12 \cdot B)/(33 + d)$	$(18 \cdot B)/(33 + d)$	

Factor f_0, f_1 for full complement cylindrical roller bearings

Series	Bearing factor f_0		Bearing factor f_1
	Grease, oil mist	Oil bath, recirculating oil	
RSL1822	5	8	0,00055
RSL1823	4	6	
RSL1830	5	7	
RSL1850	9	13	

Factor f_0, f_1 for cylindrical roller bearings with cage

Series	Bearing factor f_0		Bearing factor f_1
	Grease, oil mist	Oil bath, recirculating oil	
RN2..-E	1,3	2	0,0003
RN3..-E	1,3	2	0,00035
RN22..-E	2	3	0,0004
RN23..-E	2,7	4	0,0004

Legend

f_0 –
Bearing factor for frictional torque as a function of speed

f_1 –
Bearing factor for frictional torque as a function of load

B mm
Bearing width

d mm
Bearing bore diameter.

Speeds and acceleration

Limiting speed

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

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

Thermally safe operating speed

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

The permissible operating temperature determines the thermally safe operating speed n_ϑ of the bearing.

For calculation, it is assumed that normal operating clearance and constant operating conditions are present.

In addition to the thermally safe operating speed, the limiting speed n_G must always be observed.

Limits of the calculation method

The calculation method is not valid for:

- sealed rolling bearings with contact seals; the maximum speed is restricted by the permissible sliding velocity at the seal lip.

Permissible radial acceleration

Planetary gear bearing arrangements are subjected to strong normal accelerations in operation. In the design of the bearing arrangement, a distinction must be drawn between a full complement roller bearing arrangement and a cage bearing arrangement.

Full complement roller bearing arrangement

In full complement roller and full complement needle roller bearings, the permissible radial acceleration is restricted by the maximum pv value between the rolling elements and the thermal balance in the bearing, *Figure 1*.

Cage bearing arrangement

In cage bearing arrangements, the permissible radial acceleration is restricted by the strength of the cage.

r_{st} = distance from centre of rotation
ω = angular velocity

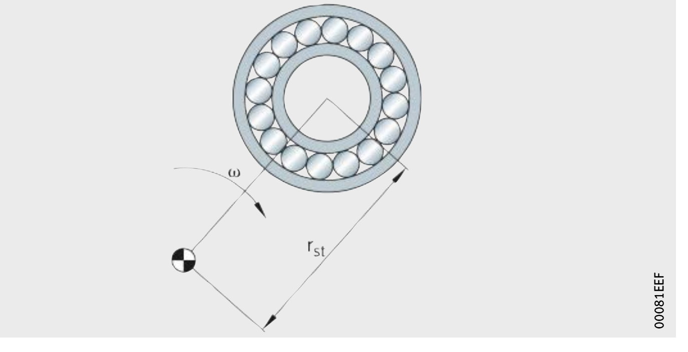


Figure 1
Radial acceleration

Radial acceleration

The radial acceleration is described by the acceleration parameter a:

$$a = \frac{1}{g} \cdot r_{st} \cdot \omega^2 = \frac{1}{g} \cdot r_{st} \cdot \left(\frac{2 \cdot \pi \cdot n}{60} \right)^2$$

a –
Acceleration parameter

g m/s^2
Acceleration due to gravity g = 9,81

r_{st} m
Distance from the centre of rotation, *Figure 1*, page 12

ω s^{-1}
Angular velocity, *Figure 1*, page 12

n min^{-1}
Relative speed of the planetary gear bearing arrangement.

Maximum acceleration

If the acceleration values are high, further advice should be sought from the Schaeffler engineering service.

Maximum acceleration for cage bearings

If bearings with cages are used, the following must be observed:

- Only use cages guided on external ribs.
- For higher accelerations, use solid cages instead of riveted cages.
- For maximum accelerations, use needle roller and cage assemblies KZK. For suitable needle roller and cage assemblies, see page 55.

Lubrication

Functions of the lubricant

The lubricant should:

- form a lubricant film sufficiently capable of supporting loads on the contact surfaces and thus prevent wear and premature fatigue
- dissipate heat in the case of oil lubrication
- reduce the running noise
- give protection against corrosion.

! The essential information on lubrication in Catalogue HR 1, Rolling Bearings, chapter Lubrication, must be observed.

Oil flow through the bearing

In order to transfer heat and lubricate the rolling elements and cage, a sufficiently large oil flow through the bearing must be ensured.

In order to ensure the outflow of oil, lubrication slots should be provided in the thrust washers where geometrical conditions are tight such as in the case of needle roller bearings, needle roller and cage assemblies and full complement needle roller sets.

Arrangement of bearings

The guidance and support of a rotating shaft requires at least two bearings arranged at a certain distance from each other.

Depending on the application, one of the following can be selected:

- locating/non-locating bearing arrangement
- adjusted bearing arrangement
- floating bearing arrangement.

! For a bearing arrangement in a planetary gear, only one bearing is used depending on the application. The essential information on the arrangement of bearings in Catalogue HR 1, Rolling Bearings, chapter Technical principles, must be observed.

Floating bearing arrangement

The floating bearing arrangement is a simple and economical design solution for supporting planetary gears. In this type of bearing arrangement, the planetary gear can be displaced relative to the planetary gear carrier by the axial clearance “s”.

The value “s” is defined as a function of the required guidance accuracy such that the bearing is not axially stressed even under unfavourable thermal conditions.

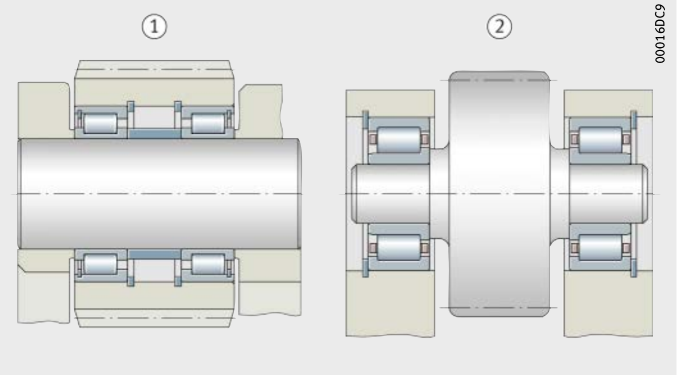
Internal or external bearing arrangement

The following bearing arrangements are possible, *Figure 1*:

- internal bearing arrangement
- external bearing arrangement.

In the internal bearing arrangement, the planetary gear runs on a pin clamped on one or both sides.

In the external bearing arrangement, the planetary gear pin is supported on both sides in the planetary gear carrier.



① Internal bearing arrangement
② External bearing arrangement

Figure 1
Bearing arrangements for planetary gears

Design examples

Example solutions show the versatile design of bearing arrangements for planetary gears, see page 24 to page 26.

Design of bearing arrangements

Fits

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

Radial and tangential location is normally achieved by force locking, i. e. by tight fits on the bearing rings.

Axial location of the bearings is normally achieved by form fit.

Criteria for selection of fits

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

- The bearing rings must be well supported on their circumference in order to allow full utilisation of the load carrying capacity of the bearing.
- The bearings must not creep on their mating parts, otherwise the seats will be damaged.

Internal bearing arrangement

If the planetary gear has an internal bearing arrangement, the outer ring of the planetary bearing has circumferential load. This ring must therefore be produced as a tight fit.

External bearing arrangement

Due to the circumferential load on the inner ring, the external bearing arrangement requires a fit with a tight seat on the inner ring.

Conditions of rotation

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

Point load

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

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

Circumferential load

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

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

Shaft and housing tolerances

The fit is determined by the ISO tolerances for shafts and housings (in accordance with ISO 286) in conjunction with the tolerances for the bore and outside diameter D of the bearings (in accordance with DIN 620).

! The type of bearing arrangement (internal or external bearing arrangement) determines the shaft and housing tolerance, see tables, page 17.

Shaft and housing tolerances for internal bearing arrangement

Condition of rotation	Bearing type	Pin diameter mm	Load	Tolerance zone
Point load on inner ring	Roller bearings	All	All	g6 (g5)
	Needle roller bearings			h6 (g6)[1]
Circumferential load on outer ring	All	All	Low	K7 (K6)
			Normal, shock type	M7 (M6)
			High, shock type ($C/P < 6$)	N7 (N6)
			High, extreme shock type, thin planetary wall thickness	P7 (P6)
				R7 For large diameters

[1] For easier fitting.

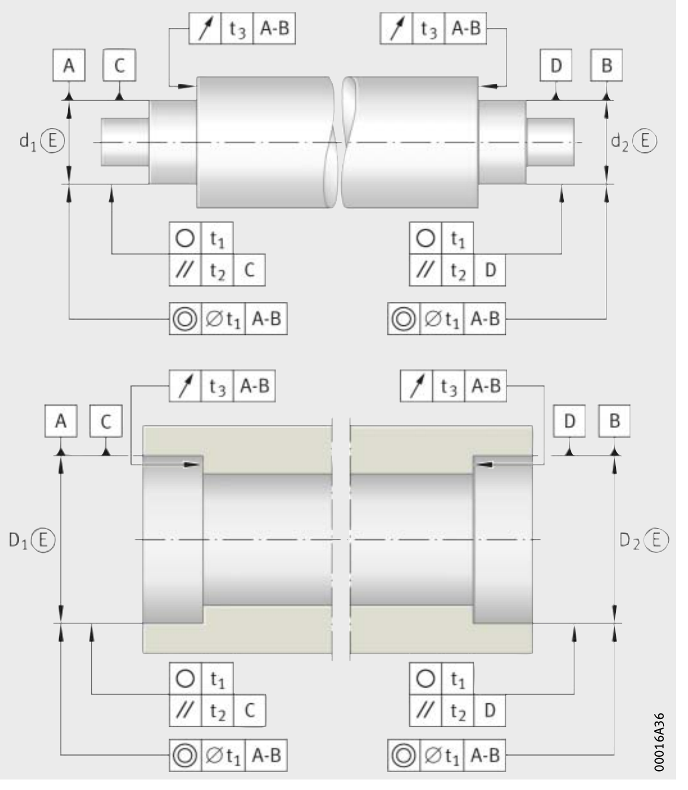
Shaft and housing tolerances for external bearing arrangement

Condition of rotation	Bearing type	Pin diameter mm	Load	Tolerance zone
Circumferential load on inner ring	Roller bearings	up to 60	Low	j6 (j5)
			Normal to high	k6 (k5)
		60 to 200	Low	k6 (k5)
			Normal	m6 (m5)
			High	n6 (n5)
		200 to 500	Normal	m6 (n5)
			High, shock type	p6
		over 500	Normal	n6 (p5)
			High	p6
Point load on outer ring	All	All	All	H7

Geometrical tolerances of bearing seating surfaces

The shaft raceway and housing bore must be designed as a function of the selected fit, *Figure 2*.

The degree of accuracy for the bearing seat tolerances on the shaft and in the housing is given in the table.



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

Figure 2
Dimensional and geometrical tolerances

IT grades in accordance with DIN ISO 286

Bearing tolerance class	Bearing seating surface	Diameter tolerance	Roundness tolerance t_1	Parallelism tolerance t_2	Axial runout tolerance of abutment shoulders t_3
PN P6X	Shaft	IT6 (IT5)	Circumferential load IT4/2	IT4	IT4
			Point load IT5/2	IT5	
	Housing	IT7 (IT6)	Circumferential load IT5/2	IT5	IT5
			Point load IT6/2	IT6	

Raceways for bearings without inner and/or outer ring

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

The bores and shafts must be produced as rolling bearing raceways (hardened and ground).

The raceways must always be free from undulations, precision machined and resistant to wear (grinding).

The mean roughness value Ra indicated in each case for a standard or X-life bearing must not be exceeded, see table. If the Ra value is higher, it is not possible to utilise the full load carrying capacity of the bearing.

Mounting of the bearing will be made easier by chamfers on both sides of the planetary gear bore.

The lateral contact running surfaces must be designed as precision machined and wear-resistant, incorporating axial washers if necessary.

Design of the rolling bearing raceway

Diameter Nominal dimension mm		Roundness µm	Parallelism[1] µm	Mean roughness Ra µm	
over	incl.			Standard	X-life
10	18	4	4	0,2	0,1
18	30	5	5		
30	50	6	7		
50	80	7	9		
80	120	8	11	0,3	0,15
120	150	9	13	0,4	0,2
150	180	13	14		
180	250	15	15		
250	315	18	16		
315	400	20	18		

[1] The parallelism of the guideway is related to the width of the planetary gear.

Materials for raceway

Through hardening steels and case hardening steels are suitable as materials.

Through hardening steels

Steels in accordance with ISO 683-17 (such as 100Cr6) are suitable. These can also be surface layer hardened.

Case hardening steels

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

Surface hardness and hardening depth

The values are applicable to raceways. Axial washers and shaft shoulders should be produced as wear-resistant surfaces, for example by hardening. Case, flame or induction hardened steels must have a surface hardness of 670 HV + 170 HV and an adequate hardening depth CHD or SHD.

In accordance with DIN 50190, the hardening depth is the depth of the hardened surface zone at which there is still a hardness of 550 HV. It is measured on the finish ground shaft and must correspond to the stated values, but must in any case be ≧ 0,3 mm.

!

If the raceways are softer than 650 HV (58 HRC), the bearing arrangement will not achieve its full load carrying capacity. In this case, the basic dynamic load rating C_r and the basic static load rating C_{0r} in the dimension tables must be reduced by the hardness factor f_H or f_{H0}, *Figure 3* and *Figure 4*.

f_H = dynamic hardness factor
HV, HRC = surface hardness

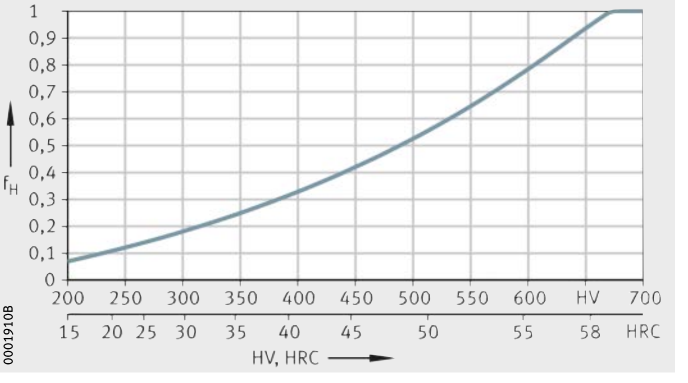


Figure 3
Dynamic hardness factor f_H

① Roller, needle roller

f_{H0} = static hardness factor
HV, HRC = surface hardness

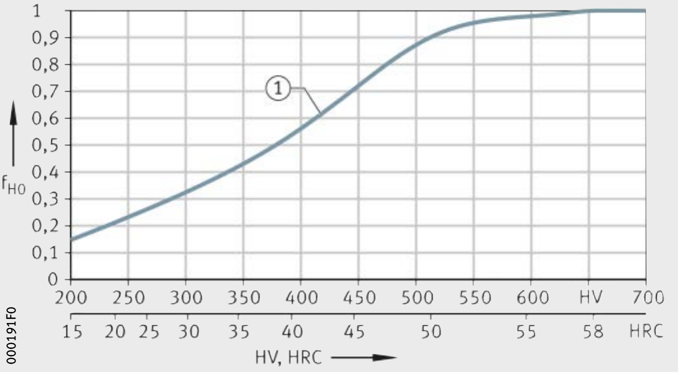


Figure 4
Static hardness factor f_{H0}

Calculation of the effective load carrying capacity

The effective load carrying capacity can be calculated using the correction equations:

$$C_{Hr} = f_H \cdot C_r$$

$$C_{0Hr} = f_{H0} \cdot C_{0r}$$

C_{Hr}, C_{0Hr} N
Effective dynamic or static load rating at reduced hardness

f_H, f_{H0} –
Dynamic or static hardness factor, *Figure 3* and *Figure 4*

C_r, C_{0r} N
Basic radial dynamic or static load rating.

Case hardening depth of raceway surfaces

The minimum case hardening depth CHD of the raceway can be determined as follows:

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

CHD mm
Case hardening depth

D_w mm
Rolling element diameter.

Roughness of bearing seating surfaces in bearings with rings

The roughness of the bearing seats must be matched to the tolerance class of the bearings. The mean roughness value Ra must not be too high, in order to maintain the interference loss within limits.

Shafts should be ground and bores should be precision turned. Recommended mean roughness Ra = 3,2.

Wall thickness between raceway and tooth base

The wall thickness between the raceway and tooth base should be at least 2,5 times the modulus.

Smaller wall thicknesses may be possible once precise calculation has been carried out by the Schaeffler engineering service.

Accuracy

The dimensional and running tolerances of the bearings correspond to tolerance class PN to DIN 620.

Tolerance for enveloping circle diameter E_w

The following tolerances are determined as a function of the bore diameter d for the enveloping circle diameter E_w:

- d ≦ 40 mm, E_w –0,01 mm
- d ≦ 65 mm, E_w –0,015 mm
- d ≦ 120 mm, E_w –0,02 mm
- d ≦ 200 mm, E_w –0,025 mm
- d ≦ 240 mm, E_w –0,03 mm.

!

The enveloping circle diameters of the bearings are given in the dimension tables.

Radial internal clearance

In bearings without an outer ring, the planetary gear fulfils the function of the outer ring. The radial internal clearance (C2, CN, C3, C4) is therefore determined by the design of the planetary gear bore and as a function of the enveloping circle diameter E_w of the rolling bearing, see tables, page 23.

Determining the diameter of the planetary gear bore as a function of the radial internal clearance (example)

For a planetary gear bearing arrangement with the cylindrical roller bearing RSL183004-A (bore diameter d = 20 mm), a radial internal clearance CN should be present.

What is the size required for the planetary gear bore?

Example:

Cylindrical roller bearing	=	RSL183004-A, see dimension table, page 34
Enveloping circle diameter F_w	=	36,81 mm, see dimension table, page 34
Tolerance for E_w	=	–0,01 mm, see page 22
Tolerance for radial internal clearance CN	=	20 μm to 45 μm, see table, page 23
Bore for planetary gear	=	36,81+0,02/+0,035

Radial internal clearance to C2 and CN

Bore diameter d mm		Bore code		Tolerance for planetary gear bore	C2 radial internal clearance µm		Tolerance for planetary gear bore	CN radial internal clearance µm	
over	incl.	over	incl.	µm	min.	max.	µm	min.	max.
–	20	–	04	0 +15	0	25	+20 +35	20	45
20	30	04	06	0 +15	0	25	+20 +35	20	45
30	40	06	08	+5 +20	5	30	+25 +40	25	50
40	50	08	10	+5 +20	5	35	+30 +45	30	60
50	65	10	13	+10 +25	10	40	+40 +55	40	70
65	80	13	16	+10 +25	10	45	+40 +55	40	75
80	100	16	20	+15 +30	15	50	+50 +65	50	85
100	120	20	24	+15 +35	15	55	+50 +70	50	90
120	140	24	28	+15 +35	15	60	+60 +80	60	105
140	160	28	32	+20 +45	20	70	+70 +95	70	120
160	180	32	36	+25 +50	25	75	+75 +100	75	125
180	200	36	40	+35 +65	35	90	+90 +120	90	145
200	220	40	44	+45 +75	45	105	+105 +135	105	165
220	240	44	48	+45 +80	45	110	+110 +145	110	175

Radial internal clearance to C3 and C4

Bore diameter d mm		Bore code		Tolerance for planetary gear bore	C3 radial internal clearance µm		Tolerance for planetary gear bore	C4 radial internal clearance µm	
over	incl.	over	incl.	µm	min.	max.	µm	min.	max.
–	20	–	04	+35 +50	35	60	+50 +65	50	75
20	30	04	06	+35 +50	35	60	+50 +65	50	75
30	40	06	08	+45 +60	45	70	+60 +75	60	85
40	50	08	10	+50 +65	50	80	+70 +85	70	100
50	65	10	13	+60 +75	60	90	+80 +95	80	110
65	80	13	16	+65 +80	65	100	+90 +105	90	125
80	100	16	20	+75 +90	75	110	+105 +120	105	140
100	120	20	24	+85 +105	85	125	+125 +145	125	165
120	140	24	28	+100 +120	100	145	+145 +165	145	190
140	160	28	32	+115 +140	115	165	+165 +190	165	215
160	180	32	36	+120 +145	120	170	+170 +195	170	220
180	200	36	40	+140 +170	140	195	+195 +225	195	250
200	220	40	44	+160 +190	160	220	+220 +250	220	280
220	240	44	48	+170 +205	170	235	+235 +270	235	300

Cylindrical roller bearings

Planetary gear bearing arrangements in industrial gearboxes can be designed in a wide variety of ways. Some bearing arrangements with cylindrical roller bearings are shown here, *Figure 1* to *Figure 6*, page 25.

RSL1830

① Retaining ring
② Axial washer

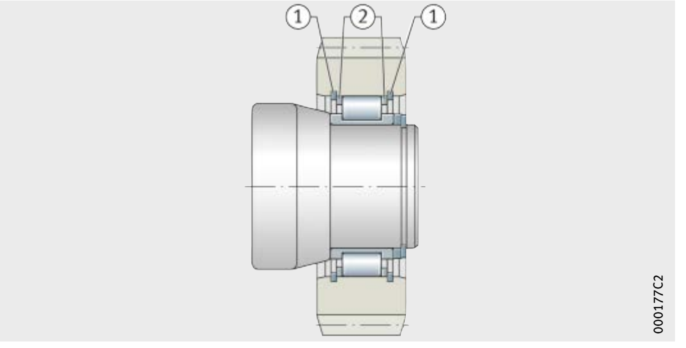


Figure 1
Full complement roller set, single row, without outer ring

RSL1830-2S

① Retaining ring
② Axial washer
③ Spacer ring

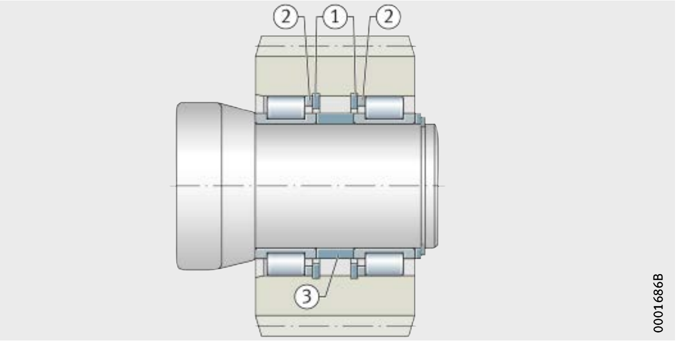


Figure 2
Full complement roller set, single row, without outer ring

RSL1850

① Retaining ring
② Axial washer

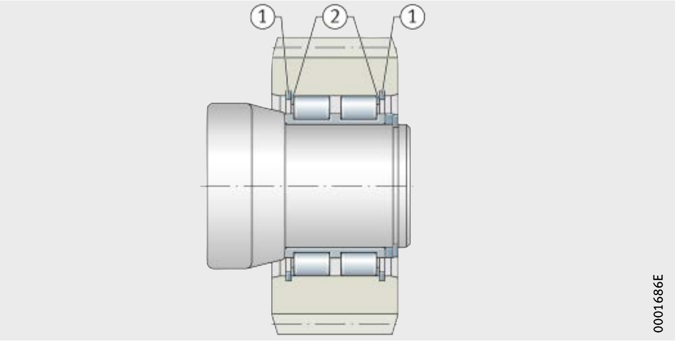
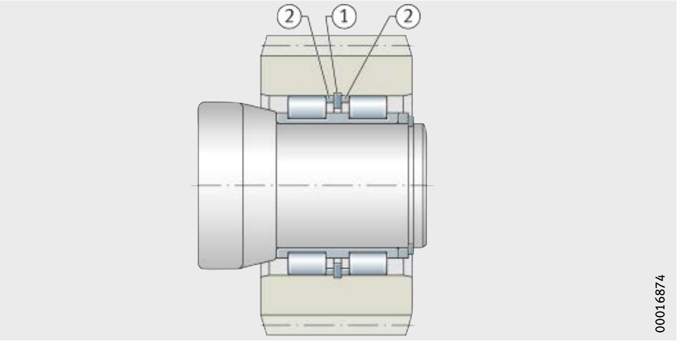


Figure 3
Full complement roller set, double row, without outer ring

RNN

① Retaining ring
② Axial washer

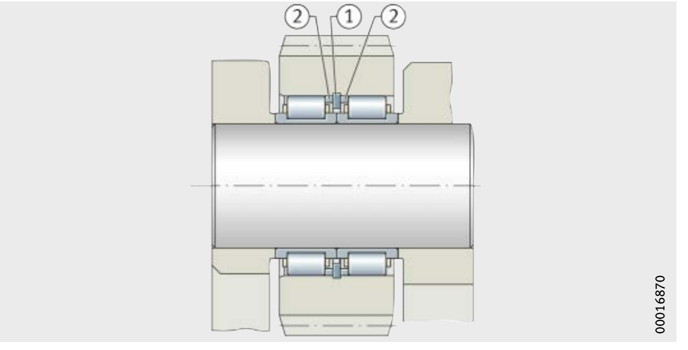
Figure 4
Special bearing,
full complement roller set,
double row, without outer ring



RN..-N12BA

① Retaining ring
② Axial washer

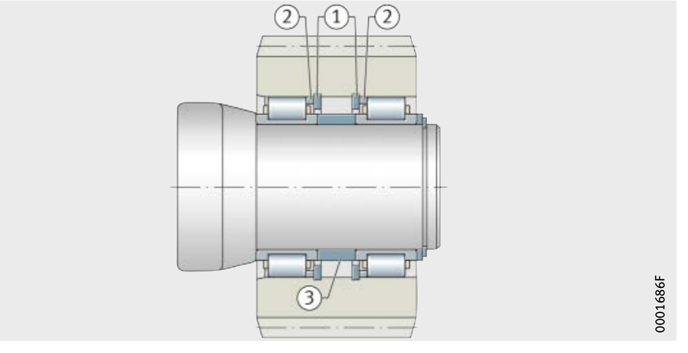
Figure 5
Bearing with cage,
without outer ring



RN

① Retaining ring
② Axial washer
③ Spacer ring

Figure 6
Bearing with cage,
without outer ring



Design examples

Needle roller and cage assembly or full complement needle roller set

Depending on the operating conditions, planetary gears can also be supported by needle roller and cage assemblies or full complement needle roller sets, *Figure 7* and *Figure 8*.

!

Radial needle roller bearings must not be used to transmit axial loads or to provide axial guidance.

K (**KZK**)

① Spacer ring
② Axial washer

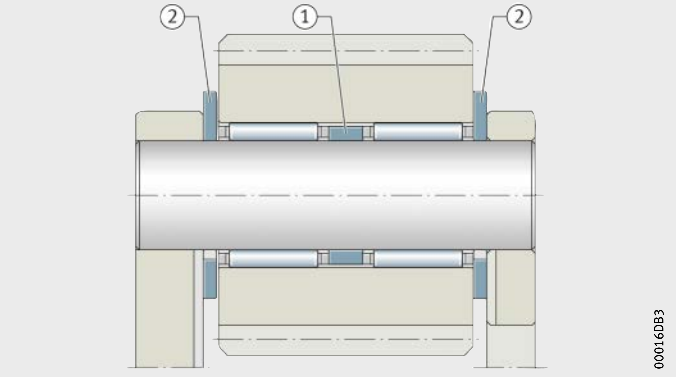


Figure 7
Bearing arrangement with double row needle roller and cage assemblies

NRB, VRS

① Axial washer

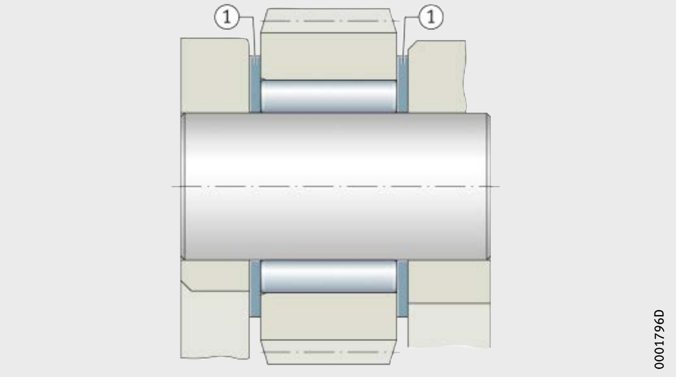


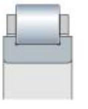
Figure 8
Full complement needle roller arrangement

Planetary gear bearings

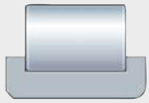
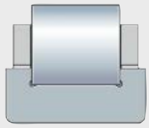
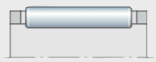
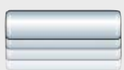
Full complement cylindrical roller bearings
Cylindrical roller bearings with cage
Needle roller and cage assemblies
Needle rollers
Full complement needle roller arrangements
Full complement needle roller sets
Spherical roller bearings
Tapered roller bearings

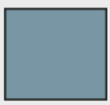
Planetary gear bearings



Matrix
Comparison of characteristics for bearing preselection

Series	Characteristic Load carrying capacity
RSL 	
RN 	
K 	
KZK 	
NRB **VRS** 	

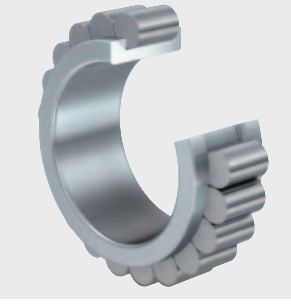
Speed	Acceleration
	
	
	
	
	

Product overview Full complement cylindrical roller bearings

Without outer ring

Single row

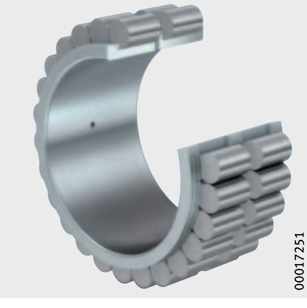
RSL1822..-A, RSL1823..-A, RSL1830..-A



00017252

Double row

RSL1850..-A



00017251

Axial washer

0001772B

Full complement cylindrical roller bearings

Features

Full complement cylindrical roller bearings without an outer ring have solid inner rings and rib-guided cylindrical rollers. The inner rings are produced with two rigid ribs.

Since these bearings have the largest possible number of rolling elements, they have extremely high radial load carrying capacity, high rigidity and are suitable for particularly compact designs. Due to the kinematic conditions, however, they do not achieve the high speeds that are possible when using cylindrical roller bearings with cage.

The bearings are available as single row and double row locating bearings. They can support not only high radial forces but also axial forces in both directions and can therefore guide shafts axially in both directions.

The bearings are supplied in an open design. They are not greased and can be lubricated with oil or grease.

The rolling elements are protected against damage and loss during transport by means of a plastic sleeve.

! The further information on cylindrical roller bearings in Catalogue HR 1, Rolling Bearings must be observed.

Ordering designation for two or more bearings

If two or more bearings are located adjacent to each other in a planet (2, 3 or 4 bearings), these must be ordered using the suffix 2S, 3S or 4S so that they are sorted together.

Design and safety guidelines

Minimum radial load

In continuous operation, a minimum radial load $F_{r\,min}$ of the order of $C_{0r}/P < 60$ is necessary.

If $C_{0r}/P > 60$, please contact us.

Axial location

In order to prevent lateral creep of the bearing rings, they must be located by means of form fit.

The abutment shoulder of the shaft should be sufficiently high and perpendicular to the bearing axis.

The transition from the bearing seat to the abutment shoulder must be designed with rounding to DIN 5418 or an undercut to DIN 509.

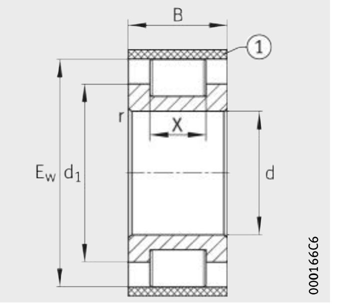
Axial guidance of planet

Cylindrical roller bearings can provide axial guidance of the planet.

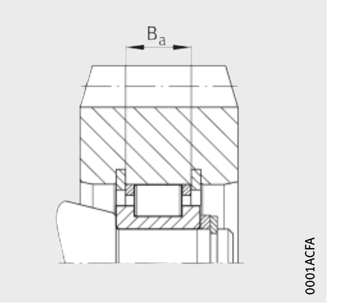
This can be carried out by means of axial washers and retaining rings arranged on both sides of the rolling element, see section Design examples, page 24. As an alternative, L-section rings BRL can be used, see page 91.

Cylindrical roller bearings

Full complement
Single row



RSL1830..-A
1 Mounting sleeve



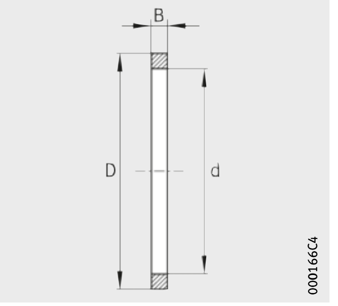
Mounting dimensions

Dimension table · Dimensions in mm

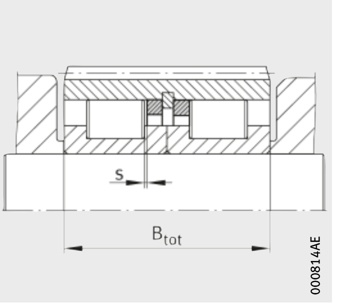
Designation[1) 2)]		Mass	Dimensions					Mounting dimensions		Basic load ratings	
	X-life	m	d	B	r	E_w[3)]	X	d_1	B_a[4)]	dyn. C_r	stat. C_{0r}
		≈kg			min.				+0,1	N	N
RSL183004-A	**XL**	0,06	**20**	16	0,6	36,81	9	29	14,2	30 500	26 500
RSL183005-A	**XL**	0,08	**25**	16	0,6	42,51	9	34,6	14	35 000	32 500
RSL183006-A	**XL**	0,12	**30**	19	1	49,6	10	40	16,7	45 000	43 000
RSL183007-A	**XL**	0,15	**35**	20	1	55,52	11	45	17,7	55 000	55 000
RSL183008-A	**XL**	0,2	**40**	21	1	61,74	12	50,5	18,7	66 000	68 000
RSL183009-A	**XL**	0,23	**45**	23	1	66,85	12	55,5	20,2	70 000	76 000
RSL183010-A	**XL**	0,25	**50**	23	1	72,33	14	59	20,2	88 000	96 000
RSL183011-A	**XL**	0,45	**55**	26	1,1	83,54	17	68,5	22,6	120 000	136 000
RSL183012-A	**XL**	0,43	**60**	26	1,1	86,74	17	71,7	22,6	123 000	145 000
RSL183013-A	**XL**	0,5	**65**	26	1,1	93,09	17	78	22,6	130 000	159 000
RSL183014-A	**XL**	0,6	**70**	30	1,1	100,28	18	81,5	26,5	153 000	176 000
RSL183015-A	**XL**	0,73	**75**	30	1,1	107,9	18	89	25,6	162 000	194 000
RSL183016-A	–	0,97	**80**	34	1,1	116,99	20	95	29,6	173 000	224 000
RSL183017-A	–	1	**85**	34	1,1	121,44	20	99,5	29,6	178 000	235 000
RSL183018-A	–	1,28	**90**	37	1,5	130,11	22	106,5	32,6	207 000	280 000
RSL183020-A	–	1,38	**100**	37	1,5	139,65	22	116	32,6	218 000	305 000
RSL183022-A	–	2,09	**110**	45	2	156,13	26	127,5	40,6	285 000	395 000
RSL183024-A	–	2,41	**120**	46	2	167,58	26	139	41,6	300 000	435 000
RSL183026-A	–	3,45	**130**	52	2	183,81	34	149	47,4	430 000	610 000
RSL183028-A	–	4,1	**140**	53	2	197,82	34	163	48,4	455 000	670 000
RSL183030-A	–	4,41	**150**	56	2,1	206,8	34	170,5	50,4	475 000	700 000
RSL183032-A	–	5,82	**160**	60	2,1	224,8	36	185	54,4	540 000	810 000
RSL183034-A	–	8,21	**170**	67	2,1	242,85	44	198,5	61,4	710 000	1 070 000
RSL183036-A	–	10,7	**180**	74	2,1	260,22	48	212,5	68,4	820 000	1 260 000
RSL183038-A	–	11,3	**190**	74	2,1	269,76	48	222	69,2	840 000	1 320 000
RSL183040-A	–	14,4	**200**	82	2,1	287,75	52	237	76,2	960 000	1 530 000

1) Suitable axial washers, see page 35.
2) Internal clearance groups and tolerances, see page 23.
3) Tolerance for enveloping circle diameter E_w, see page 22.
4) The values for the spacing B_a relate to the recommended axial washers from Schaeffler.
If other axial washers are used, the condition $B_a = X + 2 \cdot B_{axial\ washer} + 0{,}2$ must be fulfilled.

Axial washers



For RSL1830..-A



Axial clearance s

Dimension table · Dimensions in mm

Cylindrical roller bearing	Axial washer							Width between planet carriers	Retaining ring[1]
Designation	Drawing number	Mass	Dimensions			Axial clearance			
		m	d	D	B	s		B_{tot}	
		≈kg				min.	max.	min.	
RSL183004-A	F-90016	0,005	**32**	36,8	2,5	0,2	0,8	32	JV38
RSL183005-A	F-87722	0,005	**38**	42,5	2,4	0,2	0,8	32	JV42
RSL183006-A	F-87606	0,011	**43,5**	49,5	3,25	0,2	0,8	38	JV50
RSL183007-A	F-87733	0,011	**50**	55,5	3,25	0,2	0,8	40	JV55
RSL183008-A	F-87723	0,015	**55**	61,5	3,25	0,2	0,8	42	JV62
RSL183009-A	F-87591	0,02	**60**	66,5	4	0,2	0,8	46	JV67
RSL183010-A	F-87608	0,018	**65**	72	3	0,2	0,8	46	JV72
RSL183011-A	F-91631	0,022	**75**	83,5	2,7	0,3	0,9	52	JV85
RSL183012-A	F-88659	0,018	**80**	86,5	2,7	0,3	0,9	52	88X3[2]
RSL183013-A	F-91809	0,024	**85**	93	2,7	0,3	0,9	52	95X3[2]
RSL183014-A	F-88831	0,048	**90**	100	4,15	0,3	0,9	60	100X3[2]
RSL183015-A	F-89121	0,033	**100**	107,8	3,7	0,3	0,9	60	108X4[2]
RSL183016-A	F-91633	0,076	**105**	116,9	4,7	0,3	0,9	68	117X4[2]
RSL183017-A	F-91559	0,076	**110**	121,4	4,7	0,3	0,9	68	122X4[2]
RSL183018-A	F-91544	0,08	**120**	130	5,2	0,3	0,9	74	130X4[2]
RSL183020-A	F-91810	0,115	**126**	139,5	5,2	0,3	0,9	74	140X4[2]
RSL183022-A	F-91634	0,235	**138**	156	7,2	0,3	0,9	90	157X4[2]
RSL183024-A	F-91546	0,264	**150**	167,5	7,7	0,3	0,9	92	168X4[2]
RSL183026-A	F-91811	0,255	**165**	183	6,6	0,3	1,1	104	185X4[2]
RSL183028-A	F-91812	0,312	**178**	197	7,1	0,3	1,1	106	198X4[2]
RSL183030-A	F-91813	0,354	**188**	206	8,1	0,3	1,1	112	207X5[2]
RSL183032-A	F-91814	0,56	**200**	224	9,1	0,3	1,1	120	225X5[2]
RSL183034-A	F-91815	0,65	**215**	242	8,6	0,3	1,1	134	245X5[2]
RSL183036-A	F-91816	0,88	**230**	259	10,1	0,3	1,1	148	260X5[2]
RSL183038-A	F-91817	0,76	**245**	268	10,5	0,5	1,3	148	270X5[2]
RSL183040-A	F-91818	1	**260**	286	12	0,5	1,3	164	288X5[2]

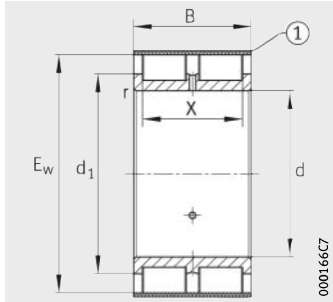
The dimension for axial location of the bearings must correspond to at least B_{tot}.
The tolerance for the spacing B_{tot} must therefore be +0,2 mm.

[1] Not included in the scope of delivery.

[2] In accordance with DIN 472.

Cylindrical roller bearings

Full complement
Double row



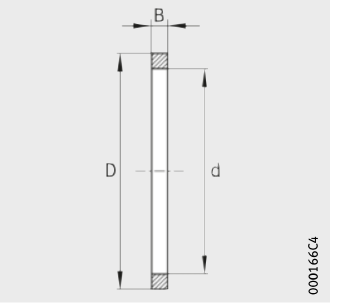
RSL1830..-A
1 Mounting sleeve

Dimension table · Dimensions in mm

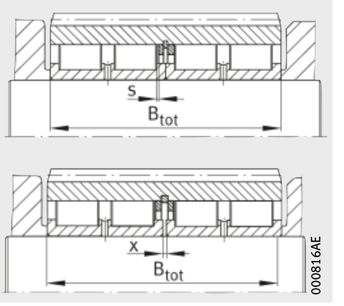
Designation[1][2]	Mass	Dimensions					Mounting dimension	Basic load ratings	
	m	d	B	r	E_w[3]	X	d_1	dyn. C_r	stat. C_{0r}
	≈kg			min.				N	N
RSL185004-A	0,12	**20**	30	0,6	36,81	23	29	46 500	52 000
RSL185005-A	0,15	**25**	30	0,6	42,51	23	34,5	53 000	64 000
RSL185006-A	0,22	**30**	34	1	49,6	26	40	69 000	84 000
RSL185007-A	0,28	**35**	36	1	55,52	28	45	83 000	107 000
RSL185008-A	0,35	**40**	38	1	61,74	30	50,5	100 000	133 000
RSL185009-A	0,42	**45**	40	1	66,85	30	55,5	106 000	148 000
RSL185010-A	0,46	**50**	40	1	72,33	33	59,5	134 000	188 000
RSL185011-A	0,86	**55**	46	1,1	83,54	39	68,5	182 000	275 000
RSL185012-A	0,79	**60**	46	1,1	86,74	39	71,5	187 000	285 000
RSL185013-A	0,94	**65**	46	1,1	93,09	39	78,8	197 000	315 000
RSL185014-A	1,12	**70**	54	1,1	100,28	42	81,5	233 000	350 000
RSL185015-A	1,46	**75**	54	1,1	107,9	42	89	245 000	385 000
RSL185016-A	1,84	**80**	60	1,1	116,99	47	95	290 000	440 000
RSL185017-A	1,9	**85**	60	1,1	121,44	47	99,5	300 000	465 000
RSL185018-A	2,48	**90**	67	1,5	130,11	52	106,5	350 000	550 000
RSL185020-A	2,6	**100**	67	1,5	139,65	52	116	370 000	600 000
RSL185022-A	3,95	**110**	80	2	156,13	62	128	485 000	770 000
RSL185024-A	4,55	**120**	80	2	167,58	62	139	510 000	950 000
RSL185026-A	6,7	**130**	95	2	183,81	78	149	730 000	1 210 000
RSL185028-A	7,9	**140**	95	2	197,82	78	163	780 000	1 340 000
RSL185030-A	8,2	**150**	100	2,1	206,8	80	170,5	810 000	1 390 000
RSL185032-A	11	**160**	109	2,1	224,8	86	185	930 000	1 610 000
RSL185034-A	15,6	**170**	122	2,1	242,85	100	198,5	1 200 000	2 110 000
RSL185036-A	20,45	**180**	136	2,1	260,22	110	212,5	1 390 000	2 480 000
RSL185038-A	21,2	**190**	136	2,1	269,76	110	222	1 430 000	2 600 000
RSL185040-A	27,4	**200**	150	2,1	287,75	120	237	1 630 000	3 000 000

1) Suitable axial washers, see page 37.
2) Internal clearance groups and tolerances, see page 23.
3) Tolerance for enveloping circle diameter E_w, see page 22.

Axial washers



For RSL1850..-A



Axial clearance s[1] or axial gap x[1]

Dimension table · Dimensions in mm

Cylindrical roller bearing	Axial washer							Width between planet carriers	Retaining ring[2]
Designation	Drawing number	Mass	Dimensions			Axial clearance			
		m	d	D	B	s		B_{tot}	
		≈kg				min.	max.	min.	
RSL185004-A	F-90016	0,005	**32**	36,8	2,5	0,4	1,3	60,2	JV38
RSL185005-A	F-87722	0,005	**38**	42,5	2,4	0,3	1,3	60,2	JV42
RSL185006-A	F-87606	0,011	**43,5**	49,5	3,25	0,2	1,1	69	JV50
RSL185007-A	F-87733	0,011	**50**	55,5	3,25	0,2	1,1	73	JV55
RSL185008-A	F-87723	0,015	**55**	61,5	3,25	0,2	1,1	772,	JV62
RSL185009-A	F-87591	0,02	**60**	66,5	4	0,2	1,1	81	JV67
RSL185010-A	F-87608	0,018	**65**	72	3	0,2	1,1	82	JV72
RSL185011-A	F-91631	0,022	**75**	83,5	2,7	0,2	1,2	94	JV85
RSL185012-A	F-88659	0,018	**80**	86,5	2,7	0,2	1,2	94	88X3[3]
RSL185013-A	F-91809	0,024	**85**	93	2,7	0,2	1,2	94	95X3[3]
RSL185014-A	F-88831	0,048	**90**	100	4,15	0,5	1,5	108,2	100X3[3]
RSL185015-A	F-89121	0,033	**100**	107,8	3,7	0,5	1,5	108,2	108X4[3]
RSL185016-A	F-91633	0,076	**105**	116,9	4,7	0,2	1,3	121	115X4[3]
RSL185017-A	F-91559	0,076	**110**	121,4	4,7	0,3	1,3	121,1	120X4[3]
RSL185018-A	F-91544	0,08	**120**	130	5,2	0,4	1,3	134,2	130X4[3]
RSL185020-A	F-91810	0,115	**126**	139,5	5,2	0,5	1,3	134,2	140X4[3]
RSL185022-A	F-91634	0,235	**138**	156	7,2	0,5	1,3	161,1	155X4[3]
RSL185024-A	F-91546	0,264	**150**	167,5	7,7	0,4	1,3	162,1	168X4[3]
RSL185026-A	F-91811	0,255	**165**	183	6,6	0,3	1,4	190,9	185X4[3]
RSL185028-A	F-91812	0,312	**178**	197	7,1	0,3	1,4	191,9	200X4[3]
RSL185030-A	F-91813	0,354	**188**	206	8,1	0,3	1,4	201,9	205X5[3]
RSL185032-A	F-91814	0,56	**200**	224	9,1	0,3	1,4	218,9	225X5[3]
RSL185034-A	F-91815	0,65	**215**	242	8,6	0,3	1,4	244,9	245X5[3]
RSL185036-A	F-91816	0,88	**230**	259	10,1	0,6	1,7	272,2	260X5[3]
RSL185038-A	F-91817	0,76	**245**	268	10,5	0,4	1,5	272,8	270X5[3]
RSL185040-A	F-91818	1	**260**	286	12	0,8	1,9	300,2	290X5[3]

The dimension for axial location of the bearings must correspond to at least B_{tot}.
The tolerance for the spacing B_{tot} must therefore be +0,2 mm.

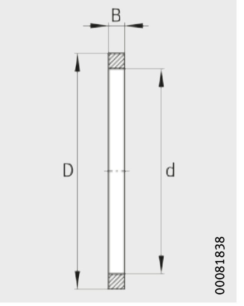
[1] If the least favourable combination of tolerances is present, it is possible that one bearing size or a combination of two bearing sizes will have either a gap x or a clearance s.

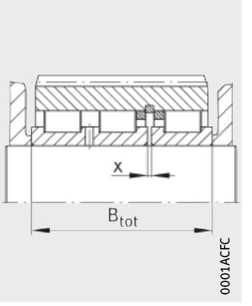
[2] Not included in the scope of delivery.

[3] In accordance with DIN 472.

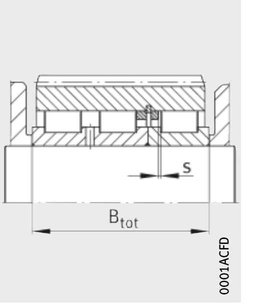
Axial washers

For the combination comprising cylindrical roller bearings RSL1850 and RSL1830





RSL1850, RSL1830
Axial gap x[1)]



RSL1850, RSL1830
Axial clearance s[1)]

Dimension table · Dimensions in mm

Cylindrical roller bearing	Axial washer							Width between planet carriers	Retaining ring[2)]
Designation	Drawing number	Mass	Dimensions			Axial clearance			
		m	d	D	B	s		B_{tot}	
		≈kg				min.	max.	min.	
RSL1850/3004	F-90016	0,005	**32**	36,8	2,5	0,3	1,3	46,2	JV38
RSL1850/3005	F-87722	0,005	**38**	42,5	2,4	0,3	1,3	46,2	JV42
RSL1850/3006	F-87606	0,011	**43,5**	49,5	3,25	0,2	1,1	53,5	JV50
RSL1850/3007	F-87733	0,011	**50**	55,5	3,25	0,2	1,1	56,5	JV55
RSL1850/3008	F-87723	0,015	**55**	61,5	3,25	0,2	1,1	59,5	JV62
RSL1850/3009	F-87591	0,02	**60**	66,5	4	0,2	1,1	63,5	JV67
RSL1850/3010	F-87608	0,018	**65**	72	3	0,2	1,1	64	JV72
RSL1850/3011	F-91631	0,022	**75**	83,5	2,7	0,2	1,1	73	JV85
RSL1850/3012	F-88659	0,018	**80**	86,5	2,7	0,2	1,1	73	88X3[3)]
RSL1850/3013	F-91809	0,024	**85**	93	2,7	0,2	1,1	73	95X3[3)]
RSL1850/3014	F-88831	0,048	**90**	100	4,15	0,4	1,5	84,2	100X3[3)]
RSL1850/3015	F-89121	0,033	**100**	107,8	3,7	0,4	1,5	84,2	108X4[3)]
RSL1850/3016	F-91633	0,076	**105**	116,9	4,7	0,3	1,3	94,5	115X4[3)]
RSL1850/3017	F-91559	0,076	**110**	121,4	4,7	0,3	1,3	94,5	120X4[3)]
RSL1850/3018	F-91544	0,08	**120**	130	5,2	0,3	1,4	104,2	130X4[3)]
RSL1850/3020	F-91810	0,115	**126**	139,5	5,2	0,3	1,4	104,2	140X4[3)]
RSL1850/3022	F-91634	0,235	**138**	156	7,2	0,2	1,2	125,5	155X4[3)]
RSL1850/3024	F-91546	0,264	**150**	167,5	7,7	0,2	1,2	127	168X4[3)]
RSL1850/3026	F-91811	0,255	**165**	183	6,6	0,2	1,3	147,4	185X4[3)]
RSL1850/3028	F-91812	0,312	**178**	197	7,1	0,2	1,3	148,9	200X4[3)]
RSL1850/3030	F-91813	0,354	**188**	206	8,1	0,2	1,3	156,9	205X5[3)]
RSL1850/3032	F-91814	0,56	**200**	224	9,1	0,2	1,3	169,4	225X5[3)]
RSL1850/3034	F-91815	0,65	**215**	242	8,6	0,2	1,4	189,4	245X5[3)]
RSL1850/3036	F-91816	0,88	**230**	259	10,1	0,5	1,6	210,2	260X5[3)]
RSL1850/3038	F-91817	0,76	**245**	268	10,5	0,3	1,5	211,3	270X5[3)]
RSL1850/3040	F-91818	1	**260**	286	12	0,7	1,9	232,2	290X5[3)]

The dimension for axial location of the bearings must correspond to at least B_{tot}.
The tolerance for the spacing B_{tot} must therefore be +0,2 mm.

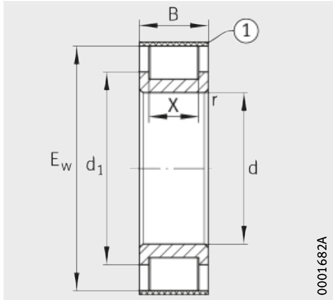
1) If the least favourable combination of tolerances is present, it is possible that one bearing size or a combination of two bearing sizes will have either a gap x or a clearance s.

2) Not included in the scope of delivery.

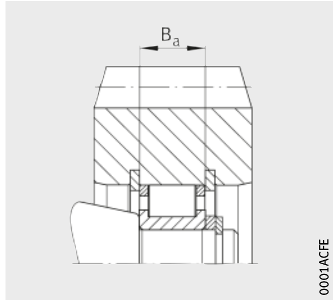
3) In accordance with DIN 472.

Cylindrical roller bearings

Full complement
Single row



RSL1822..-A
① Mounting sleeve



Mounting dimensions

Dimension table · Dimensions in mm

Designation[1) 2)]	X-life	Mass m ≈kg	Dimensions d	B	r min.	E_w[3)]	X	Mounting dimensions d_1	B_a[4)] +0,1	Basic load ratings dyn. C_r N	stat. C_{0r} N
RSL182204-A	**XL**	0,1	**20**	18	1	41,47	12	30,3	16	45 500	37 000
RSL182205-A	**XL**	0,12	**25**	18	1	46,52	12	35,3	16	51 000	44 500
RSL182206-A	**XL**	0,19	**30**	20	1	55,19	14	42	17,8	70 000	64 000
RSL182207-A	**XL**	0,27	**35**	23	1,1	63,97	15	47	20,2	88 000	78 000
RSL182208-A	**XL**	0,34	**40**	23	1,1	70,94	15	54	20,2	97 000	39 000
RSL182209-A	**XL**	0,34	**45**	23	1,1	74,43	15	57,5	20,2	101 000	98 000
RSL182210-A	**XL**	0,41	**50**	23	1,1	81,4	15	64,4	20,2	109 000	111 000
RSL182211-A	**XL**	0,54	**55**	25	1,5	88,81	18	70	21,6	140 000	148 000
RSL182212-A	**XL**	0,76	**60**	28	1,5	99,17	20	76,8	24,5	169 000	176 000
RSL182213-A	**XL**	0,95	**65**	31	1,5	106,25	22	82,3	26,5	198 000	210 000
RSL182214-A	–	0,98	**70**	31	1,5	111,01	22	87	26,5	181 000	223 000
RSL182215-A	–	1,03	**75**	31	1,5	115,78	22	92	26,5	187 000	236 000
RSL182216-A	–	1,33	**80**	33	2	125,81	24	98,5	28,5	223 000	280 000
RSL182217-A	–	1,61	**85**	36	2	133,21	26	104,5	31,5	255 000	320 000
RSL182218-A	–	1,96	**90**	40	2	140,61	28	110	35,6	285 000	365 000
RSL182220-A	–	3,35	**100**	46	2,1	162,81	34	127,5	41,6	390 000	510 000
RSL182222-A	–	4,22	**110**	53	2,1	177	36	137	48,6	450 000	580 000
RSL182224-A	–	5,57	**120**	58	2,1	192,32	40	151	53,6	530 000	720 000
RSL182226-A	–	7,08	**130**	64	3	207,12	44	162,3	58,4	620 000	850 000
RSL182228-A	–	8,66	**140**	68	3	221,92	48	174	62,4	720 000	1 000 000
RSL182230-A	–	10,53	**150**	73	3	236,71	52	185,5	67,4	830 000	1 180 000
RSL182232-A	–	16	**160**	80	3	266,36	58	208,8	74,4	870 000	1 190 000
RSL182234-A	–	19,18	**170**	86	4	281,09	62	220,3	80,4	1 140 000	1 660 000
RSL182236-A	–	20,7	**180**	86	4	293,22	62	232,4	80,4	1 020 000	1 440 000
RSL182238-A	–	24	**190**	92	4	310,68	64	243,5	85,2	1 310 000	1 920 000
RSL182240-A	–	26	**200**	98	4	318,6	68	246,6	91,2	1 420 000	2 040 000

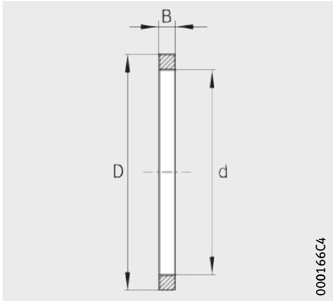
1) Suitable axial washers, see page 41.

2) Internal clearance groups and tolerances, see page 23.

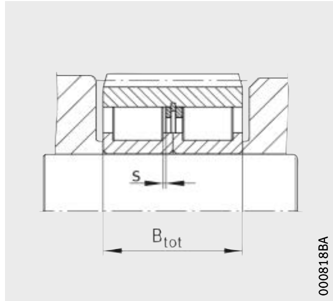
3) Tolerance for enveloping circle diameter E_w, see page 22.

4) The values for the spacing B_a relate to the recommended axial washers from Schaeffler.
If other axial washers are used, the condition $B_a = X + 2 \cdot B_{axial\ washer} + 0{,}2$ must be fulfilled.

Axial washers



For RSL1822..-A



Axial clearance s

Dimension table · Dimensions in mm

Cylindrical roller bearing Designation	Axial washer Drawing number	Mass m ≈kg	Dimensions d	 D	 B	Axial clearance s min.	 max.	Width between planet carriers B_{tot} min.	Retaining ring[1]
RSL182204-A	F-91911	0,005	**35**	41	1,9	0,2	0,8	36	JV42
RSL182205-A	F-91912	0,006	**40**	46	1,9	0,2	0,8	36	JV47
RSL182206-A	F-91913	0,008	**48**	55	1,8	0,2	0,8	40	JV55
RSL182207-A	F-91635	0,015	**55**	63,5	2,5	0,2	0,8	46	JV66
RSL182208-A	F-90397	0,012	**64**	70,5	2,5	0,2	0,8	46	JV72
RSL182209-A	F-91914	0,019	**65**	74	2,5	0,2	0,8	46	75X2,5[2]
RSL182210-A	F-90398	0,021	**72**	81	2,5	0,2	0,8	46	82X2,5[2]
RSL182211-A	F-91915	0,015	**80**	88,5	1,7	0,2	0,8	50	88X3[2]
RSL182212-A	F-201710	0,021	**90**	98,5	2,15	0,2	0,8	56	100X3[2]
RSL182213-A	F-90399	0,026	**96**	105,8	2,15	0,2	1,1	62	107X4[2]
RSL182214-A	F-201701	0,025	**101**	110,5	2,15	0,2	1,1	62	110X4[2]
RSL182215-A	F-90400	0,028	**105**	115	2,15	0,2	1,1	62	115X4[2]
RSL182216-A	F-200908	0,031	**115**	125	2,15	0,2	1,1	66	125X4[2]
RSL182217-A	F-90401	0,05	**120**	132,8	2,65	0,2	1,1	72	132X4[2]
RSL182218-A	F-204890	0,065	**129**	140	3,7	0,2	1,1	80	140X4[2]
RSL182220-A	F-91917	0,08	**150**	162	3,7	0,2	1,1	92	160X4[2]
RSL182222-A	F-211162	0,15	**165**	176,5	6,2	0,2	1,1	106	177X4[2]
RSL182224-A	F-91918	0,33	**170**	192	6,7	0,2	1,1	116	192X4[2]
RSL182226-A	F-232876	0,25	**192**	206,5	7,1	0,3	1,5	128	207X5[2]
RSL182228-A	–	0,28	**206**	221	7,1	0,3	1,5	136	222X5[2]
RSL182230-A	F-235626	0,34	**220**	236	7,6	0,3	1,5	146	237X5[2]
RSL182232-A	F-589849	0,45	**248**	265,5	8,1	0,3	1,5	160	267X5[2]
RSL182234-A	–	0,58	**261**	280	9,1	0,3	1,5	172	282X5[2]
RSL182236-A	F-206052	0,61	**273**	292,5	9,1	0,3	1,5	172	292X5[2]
RSL182238-A	–	0,81	**289**	310	10,5	0,5	1,8	184	310X6[2]
RSL182240-A	F-237454	1	**295**	319	11,5	0,5	1,8	196	320X6[2]

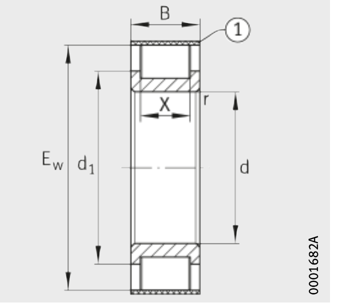
The dimension for axial location of the bearings must correspond to at least B_{tot}.
The tolerance for the spacing B_{tot} must therefore be +0,2 mm.

[1] Not included in the scope of delivery.

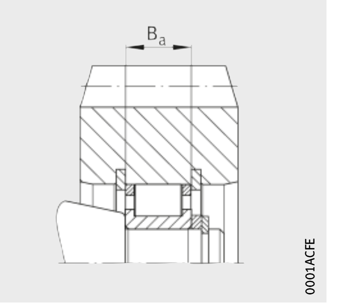
[2] In accordance with DIN 472.

Cylindrical roller bearings

Full complement
Single row



RSL1823..-A
① Mounting sleeve



Mounting dimensions

Dimension table · Dimensions in mm

Designation[1) 2)]	Mass	Dimensions					Mounting dimensions		Basic load ratings	
	m	d	B	r	E_w[3)]	X	d_1	B_a[4)]	dyn. C_r	stat. C_{0r}
	≈kg			min.				+0,1	N	N
RSL182305-A	0,21	**25**	24	1,1	53,717	15	36,7	21,8	63 000	57 000
RSL182306-A	0,33	**30**	27	1,1	62,3	18	43,5	24,8	87 000	85 000
RSL182307-A	0,5	**35**	31	1,5	72,68	20	51	28,2	113 000	112 000
RSL182308-A	0,74	**40**	33	1,5	83,124	24	58	30,2	152 000	155 000
RSL182309-A	0,84	**45**	36	1,5	88,322	24	61,5	32,6	162 000	165 000
RSL182310-A	1,17	**50**	40	2	98,718	28	68,5	36,6	205 000	215 000
RSL182311-A	1,54	**55**	43	2	109,11	30	76	38,6	242 000	255 000
RSL182312-A	1,78	**60**	46	2,1	115,62	30	82,5	41,6	260 000	280 000
RSL182313-A	2,36	**65**	48	2,1	126,69	34	90	43,6	315 000	355 000
RSL182314-A	2,63	**70**	51	2,1	132,14	36	94	46,6	345 000	390 000
RSL182315-A	3,43	**75**	55	2,1	143,22	40	102	50,6	410 000	475 000
RSL182316-A	4,33	**80**	58	2,1	154,24	44	110	53,6	480 000	560 000
RSL182317-A	4,58	**85**	60	3	163,01	44	118,5	55,6	510 000	620 000
RSL182318-A	5,15	**90**	64	3	165,26	48	117,5	59,6	560 000	660 000
RSL182319-A	6,03	**95**	67	3	174,66	48	126,6	62,6	580 000	720 000
RSL182320-A	7,75	**100**	73	3	187,303	55	133	68,6	710 000	860 000
RSL182322-A	11,5	**110**	80	3	218,27	56	151,5	74,6	840 000	970 000
RSL182324-A	14,3	**120**	86	3	231,386	64	164,5	80,4	1 000 000	1 230 000
RSL182326-A	17,4	**130**	93	4	247,9	68	176	87,4	1 120 000	1 400 000
RSL182328-A	21,1	**140**	102	4	264,447	72	187,5	96,4	1 260 000	1 580 000
RSL182330-A	27,2	**150**	108	4	286,49	80	203,3	102,4	1 490 000	1 900 000

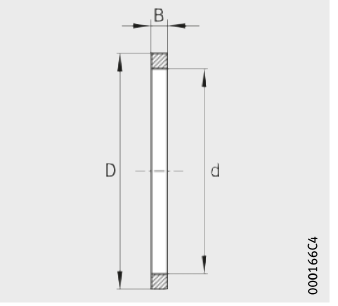
1) Suitable axial washers, see page 43.

2) Internal clearance groups and tolerances, see page 23.

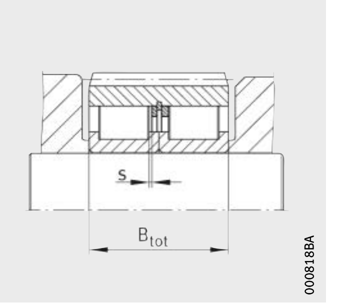
3) Tolerance for enveloping circle diameter E_w, see page 22.

4) The values for the spacing B_a relate to the recommended axial washers from Schaeffler.
If other axial washers are used, the condition $B_a = X + 2 \cdot B_{axial\ washer} + 0{,}2$ must be fulfilled.

Axial washers



For RSL1823..-A



Axial clearance s

Dimension table · Dimensions in mm

Cylindrical roller bearing	Axial washer							Width between planet carriers	Retaining ring[1) 2)]
Designation	Drawing number	Mass	Dimensions			Axial clearance			
		m	d	D	B	s		B_{tot}	
		≈kg				min.	max.	min.	
RSL182305-A	F-92059	0,013	**47**	53,5	3,3	0,1	0,7	48	54X2
RSL182306-A	F-92060	0,017	**55**	62	3,3	0,1	0,7	54	64X2
RSL182307-A	F-92061	0,028	**64**	72,5	4	0,2	0,8	62	72X2,5
RSL182308-A	F-92062	0,018	**77**	83	3	0,2	0,8	66	82X2,5
RSL182309-A	F-92063	0,039	**79**	88	4,2	0,3	0,9	72	88X3
RSL182310-A	F-92064	0,053	**90**	98,5	4,2	0,3	0,9	80	100X3
RSL182311-A	F-92065	0,045	**100**	109	4,2	0,3	0,9	86	110X4
RSL182312-A	F-92066	0,082	**105**	115,6	5,7	0,3	0,9	92	115X4
RSL182313-A	F-92067	0,067	**117**	126,5	4,7	0,3	0,9	96	128X4
RSL182314-A	F-92068	0,09	**121**	132	5,2	0,3	0,9	102	130X4
RSL182315-A	F-92069	0,1	**132**	143	5,2	0,3	0,9	110	145X4
RSL182316-A	F-92070	0,085	**144**	154	4,7	0,3	0,9	116	155X4
RSL182317-A	F-92071	0,132	**151**	163	5,7	0,2	0,9	120	165X4
RSL182318-A	F-92072	0,13	**153**	165	5,7	0,2	0,9	128	165X4
RSL182319-A	F-92073	0,215	**160**	174,5	7,2	0,2	0,9	134	175X4
RSL182320-A	F-92074	0,206	**173**	187	6,7	0,2	0,9	146	185X4
RSL182322-A	F-92075	0,45	**199**	218	9,2	0,2	0,9	160	220X4
RSL182324-A	F-92076	0,38	**214**	231	8,1	0,3	1,1	172	230X4
RSL182326-A	F-92077	0,55	**228**	247,5	9,6	0,3	1,5	186	248X5
RSL182328-A	F-225795	0,9	**240**	264	12,1	0,3	1,5	204	265X5
RSL182330-A	–	0,83	**264**	286	11,1	0,3	1,5	216	287X5

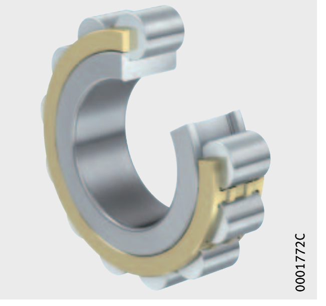
The dimension for axial location of the bearings must correspond to at least B_{tot}.
The tolerance for the spacing B_{tot} must therefore be +0,2 mm.

1) Not included in the scope of delivery.

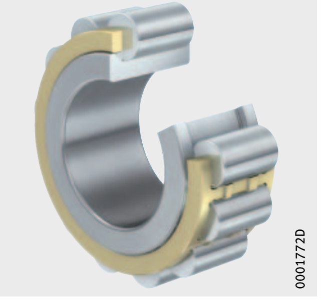
2) In accordance with DIN 472.

Single row

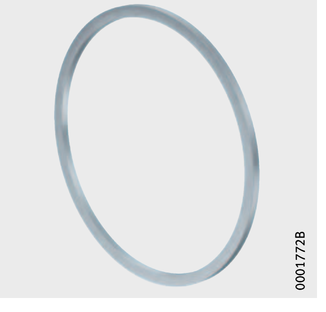
RN2, RN3



RN22, RN23



Axial washer



Cylindrical roller bearings with cage

Features

Single row cylindrical roller bearings with cage and without an outer ring are units comprising solid inner rings and cylindrical roller and cage assemblies. The inner rings have two rigid ribs. The cage prevents the cylindrical rollers from coming into contact with each other during rolling.

The cage type bearings are very rigid, can support high radial loads and are suitable for higher speeds than the full complement designs. They have a roller set with increased capacity and are thus designed for extremely high load carrying capacity.

The bearings are in the form of single row locating bearings. They can support not only high radial forces but also axial forces in both directions and can therefore guide shafts axially in both directions.

The bearings are supplied in an open design. They are not greased and can be lubricated from the end faces using grease or oil.

The rolling elements are protected against damage and loss during transport by means of a plastic sleeve.

!

The further information on cylindrical roller bearings in Catalogue HR 1, Rolling Bearings must be observed.

Ordering designation for two or more bearings

If two or more bearings are located adjacent to each other in a planet (2, 3, 4 bearings), these must be ordered using the suffix N12BA and the quantity (×2, ×3 or ×4) so that they are sorted together.

Design and safety guidelines

Minimum radial load

In continuous operation, a minimum radial load $F_{r\,min}$ of the order of $F_{r\,min} = C_{0r}/60$ is necessary.

If $C_{0r}/P > 60$, please contact us.

Axial location

In order to prevent lateral creep of the bearing rings, they must be located by means of form fit.

The abutment shoulder of the shaft should be sufficiently high and perpendicular to the bearing axis.

The transition from the bearing seat to the abutment shoulder must be designed with rounding to DIN 5418 or an undercut to DIN 509.

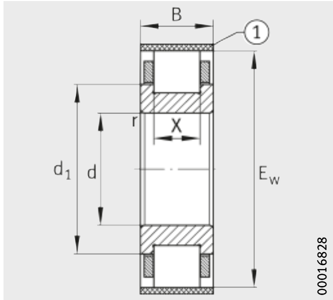
Axial guidance of planet

Cylindrical roller bearings can provide axial guidance of the planet.

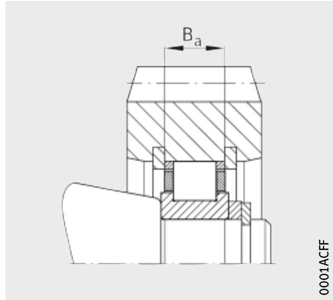
This can be carried out by means of axial washers and retaining rings arranged on both sides of the rolling element, see section Design examples, page 24. As an alternative, L-section rings BRL can be used, see page 91.

Cylindrical roller bearings

With cage
Single row



RN2..-E-MPBX
① Mounting sleeve



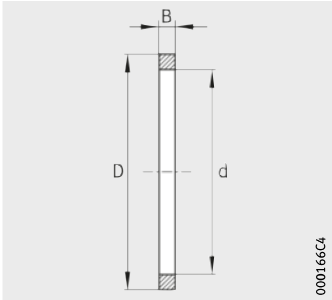
Mounting dimensions

Dimension table · Dimensions in mm

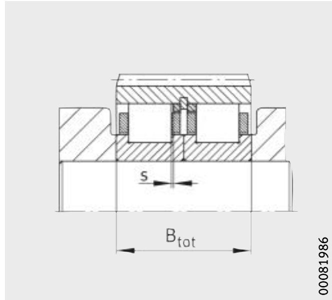
Designation[1) 2) 3)]	X-life	Mass m ≈kg	Dimensions d	B	r min.	E_w[4)]	X	Mounting dimensions d_1	B_a[5)] +0,1	Basic load ratings dyn. C_r N	stat. C_{0r} N
RN204-E-MPBX	**XL**	0,079	**20**	14	1	41,5	9	29,7	12,2	32 500	24 700
RN205-E-MPBX	**XL**	0,094	**25**	15	1	46,5	9	34,7	13,2	34 500	27 500
RN206-E-MPBX	**XL**	0,147	**30**	16	1	55,5	10	41,3	14,2	45 000	37 500
RN207-E-MPBX	**XL**	0,213	**35**	17	1,1	64	11	48	15,2	58 000	50 000
RN208-E-MPBX	**XL**	0,25	**40**	18	1,1	71,5	11	54	16,2	63 000	53 000
RN209-E-MPBX	**XL**	0,32	**45**	19	1,1	76,5	12	59	16,7	72 000	63 000
RN210-E-MPBX	**XL**	0,35	**50**	20	1,1	81,5	12	64	17,7	75 000	69 000
RN211-E-MPBX	**XL**	0,47	**55**	21	1,5	90	14	70,8	18,2	99 000	95 000
RN212-E-MPBX	**XL**	0,64	**60**	22	1,5	100	14	77,5	19,2	111 000	104 000
RN213-E-MPBX	**XL**	0,78	**65**	23	1,5	108,5	15	84,4	20,2	127 000	120 000
RN214-E-MPBX	**XL**	0,86	**70**	24	1,5	113,5	16	89,4	21,2	140 000	137 000
RN215-E-MPBX	**XL**	0,96	**75**	25	1,5	118,5	17	94,3	22,2	154 000	156 000
RN216-E-MPBX	**XL**	1,18	**80**	26	2	127,3	17	101,5	23,2	165 000	170 000
RN217-E-MPBX	**XL**	1,45	**85**	28	2	136,5	19	107,5	25,2	194 000	194 000
RN218-E-MPBX	**XL**	1,73	**90**	30	2	145	20	114,3	27,2	215 000	217 000
RN219-E-MPBX	**XL**	2,18	**95**	32	2,1	154,5	22	120,5	29,2	260 000	265 000
RN220-E-MPBX	**XL**	2,55	**100**	34	2,1	163	24	127,3	31,2	295 000	305 000
RN222-E-MPBX	**XL**	3,57	**110**	38	2,1	180,5	26	141,6	35,2	345 000	365 000
RN224-E-MPBX	**XL**	4,41	**120**	40	2,1	195,5	28	153,2	36,7	390 000	415 000
RN226-E-MPBX	**XL**	5,04	**130**	40	3	209,5	28	163,9	36,7	425 000	450 000
RN228-E-MPBX	**XL**	6,01	**140**	42	3	225	28	179,4	38,7	460 000	510 000
RN230-E-MPBX	**XL**	7,56	**150**	45	3	242	30	193,1	41,7	520 000	590 000
RN232-E-MPBX	**XL**	9,29	**160**	48	3	259	32	206,8	43,7	590 000	670 000
RN234-E-MPBX	**XL**	12	**170**	52	4	279	36	218,4	47,7	700 000	780 000
RN236-E-MPBX	**XL**	12,6	**180**	52	4	289	36	230,8	47,7	730 000	830 000
RN238-E-MPBX	–	15	**190**	55	4	306	38	243,9	50,7	680 000	930 000
RN240-E-MPBX	–	17,7	**200**	58	4	323	40	258,2	53,7	750 000	1 040 000
RN244-E-MPBX	–	24,7	**220**	65	4	358	45	285,2	60,7	950 000	1 320 000
RN248-E-MPBX	–	33,2	**240**	72	4	393	50	312	67,7	1 140 000	1 600 000

1) Suitable axial washers, see page 47.
2) Internal clearance groups and tolerances, see page 23.
3) Depending on availability, one bearing can also be supplied with a cage of matching dimensions and the suffix MP1B.
4) Tolerance for enveloping circle diameter E_w, see page 22.
5) The values for the spacing B_a relate to the recommended axial washers from Schaeffler. If other axial washers are used, the condition $B_a = X + 2 \cdot B_{axial\ washer} + 0{,}2$ must be fulfilled.

Axial washers



For RN2..-E-MPBX



Axial clearance s

Dimension table · Dimensions in mm

Cylindrical roller bearing	Axial washer							Width between planet carriers	Retaining ring[1]
Designation	Drawing number[2]	Mass	Dimensions			Axial clearance			
		m	d	D	B	s		B_{tot}	
		≈g				min.	max.	min.	
RN204-E-MPBX	–	2,3	**38,45**	41,5	1,5	0,4	0,9	28	SB42 1,5X2,3
RN205-E-MPBX	–	3,4	**43,45**	46,5	2	0,4	0,9	30	SB46 1,5X2,3
RN206-E-MPBX	–	4,5	**52,1**	55,5	2	0,4	0,9	32	SB55 1,5X2,3
RN207-E-MPBX	–	5,6	**60,36**	64	2	0,4	0,9	34	SB65 1,5X2,3
RN208-E-MPBX	–	8,4	**67,56**	71,5	2,5	0,4	0,9	36	SB72 1,5X2,3
RN209-E-MPBX	–	8,1	**72,6**	76,5	2,25	0,4	0,9	38	SB76 2X2,8
RN210-E-MPBX	–	10,6	**77,58**	81,5	2,75	0,4	0,9	40	SB81 2X2,8
RN211-E-MPBX	–	8,9	**85,88**	90	2	0,3	0,9	42	SB90 2,5X3,4
RN212-E-MPBX	–	14,4	**95,22**	100	2,5	0,3	0,9	44	SB100 2,5X3,4
RN213-E-MPBX	–	16,4	**103,48**	108,5	2,5	0,3	0,9	46	SB108 2,5X3,4
RN214-E-MPBX	–	17,3	**108,44**	113,5	2,5	0,3	0,9	48	SB113 2,5X3,4
RN215-E-MPBX	–	18,1	**113,4**	118,5	2,5	0,3	0,9	50	SB118 2,5X3,4
RN216-E-MPBX	–	24,7	**121,9**	127,3	3	0,3	0,9	52	SB127 2,5X3,4
RN217-E-MPBX	–	29,2	**130,6**	136,5	3	0,3	0,9	56	SB137 2,5X3,4
RN218-E-MPBX	–	38,1	**138,78**	145	3,5	0,3	0,9	60	SB143 2,5X4
RN219-E-MPBX	–	44,4	**147,68**	154,5	3,5	0,3	0,9	64	SB153 2,5X4
RN220-E-MPBX	–	49	**155,88**	163	3,5	0,3	0,9	68	SB163 2,5X4
RN222-E-MPBX	–	75,6	**172,78**	180,5	4,5	0,3	0,9	76	SB180 2,5X4
RN224-E-MPBX	–	83,4	**187,18**	195,5	4,25	0,3	0,9	80	SB195 3X5
RN226-E-MPBX	–	95,2	**200,64**	209,5	4,25	0,3	0,9	80	SB210 3X5
RN228-E-MPBX	–	127	**216,1**	225	5,25	0,3	0,9	84	SB225 3X5
RN230-E-MPBX	–	158,1	**232,6**	242	5,75	0,3	0,9	90	SB240 3X5
RN232-E-MPBX	–	181,8	**248,9**	259	5,75	0,2	0,9	96	SB260 4X7,5
RN234-E-MPBX	–	217	**267,8**	279	5,75	0,2	0,9	104	SB280 4X7,5
RN236-E-MPBX	–	223	**277,9**	289	5,75	0,2	0,9	104	SB290 4X7,5
RN238-E-MPBX	–	270,5	**294,3**	306	6,25	0,2	1	110	SB310 4X7,5
RN240-E-MPBX	–	324,2	**310,7**	323	6,75	0,2	1	116	SB325 4X7,5
RN244-E-MPBX	–	466,1	**344,1**	358	7,75	0,2	1	130	SB360 4X7,5
RN248-E-MPBX	–	713	**375,8**	393	8,75	0,2	1,1	144	SB395 4X7,5

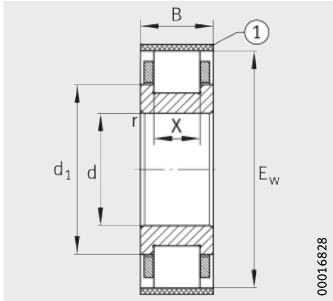
The dimension for axial location of the bearings must correspond to at least B_{tot}.
The tolerance for the spacing B_{tot} must therefore be +0,2 mm.

1) Not included in the scope of delivery.

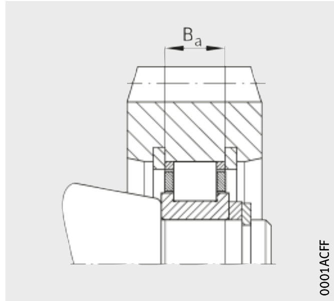
2) This will be determined once an order is placed.

Cylindrical roller bearings

With cage
Single row



RN3..-E-MPBX (-EX-MPBX)
① Mounting sleeve



Mounting dimensions

Dimension table · Dimensions in mm

Designation[1) 2) 3)]		Mass	Dimensions					Mounting dimensions		Basic load ratings	
	X-life	m	d	B	r	E_w[4)]	X	d_1	B_a[5)]	dyn. C_r	stat. C_{0r}
		≈kg			min.				+0,1	N	N
RN304-E-MPBX	**XL**	0,106	**20**	15	1,1	45,5	10	31,3	13,2	36 500	27 000
RN305-E-MPBX	**XL**	0,167	**25**	17	1,1	54	11	38,1	15,2	48 000	37 500
RN306-E-MPBX	**XL**	0,245	**30**	19	1,1	62,5	12	45	17,2	61 000	48 000
RN307-E-MPBX	**XL**	0,34	**35**	21	1,5	70,2	14	51	19,2	76 000	63 000
RN308-E-MPBX	**XL**	0,48	**40**	23	1,5	80	15	57,6	20,7	95 000	78 000
RN309-E-MPBX	**XL**	0,63	**45**	25	1,5	88,5	16	64,4	22,2	115 000	100 000
RN310-E-MPBX	**XL**	0,81	**50**	27	2	97	17	71,3	24,2	130 000	114 000
RN311-E-MPBX	**XL**	1,06	**55**	29	2	106,5	19	77,5	26,2	159 000	140 000
RN312-E-MPBX	**XL**	1,31	**60**	31	2,1	115	20	84,4	28,2	177 000	157 000
RN313-E-MPBX	**XL**	1,65	**65**	33	2,1	124,5	22	90,5	30,2	214 000	191 000
RN314-E-MPBX	**XL**	2,01	**70**	35	2,1	133	24	97,5	32,2	242 000	222 000
RN315-E-MPBX	**XL**	2,49	**75**	37	2,1	143	26	104,1	34,2	285 000	265 000
RN316-E-MPBX	**XL**	3,04	**80**	39	2,1	151	27	110,4	36,2	300 000	275 000
RN317-E-MPBX	**XL**	3,42	**85**	41	3	160	28	117,8	38,2	340 000	325 000
RN318-E-MPBX	**XL**	4,02	**90**	43	3	169,5	30	124	40,2	370 000	350 000
RN319-E-MPBX	**XL**	4,53	**95**	45	3	177,5	30	132	42,2	390 000	380 000
RN320-E-MPBX	**XL**	5,75	**100**	47	3	191,5	32	139,4	43,7	450 000	425 000
RN322-E-MPBX	**XL**	7,46	**110**	50	3	211	34	155,6	46,7	520 000	510 000
RN324-E-MPBX	**XL**	9,7	**120**	55	3	230	38	168,7	51,7	610 000	600 000
RN326-E-MPBX	**XL**	11,8	**130**	58	4	247	40	181,7	54,7	720 000	720 000
RN328-E-MPBX	**XL**	14,1	**140**	62	4	264	42	195,4	57,7	790 000	800 000
RN330-E-MPBX	**XL**	17,4	**150**	65	4	283	45	209,5	60,7	900 000	930 000
RN332-E-MPBX	–	21,2	**160**	68	4	300	48	221,6	63,7	865 000	1 060 000
RN334-E-MPBX	–	25,7	**170**	72	4	318	50	237	67,7	965 000	1 220 000
RN336-E-MPBX	–	28,2	**180**	75	4	335	52	250,5	70,7	1 040 000	1 320 000
RN338-E-MPBX	–	32,4	**190**	78	5	353	54	265,4	73,7	1 120 000	1 430 000
RN340-E-MPBX	–	36,6	**200**	80	5	370	56	279	75,7	1 180 000	1 530 000
RN344-EX-MPBX	–	49	**220**	88	5	406	62	305,1	83,7	1 430 000	1 900 000
RN348-EX-MPBX	–	62,4	**240**	95	5	442	68	331,3	89,7	1 730 000	2 280 000

1) Suitable axial washers, see page 49.

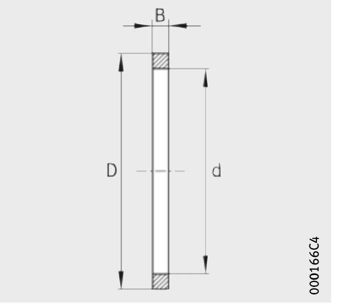
2) Internal clearance groups and tolerances, see page 23.

3) Depending on availability, one bearing can also be supplied with a cage of matching dimensions and the suffix MP1B.

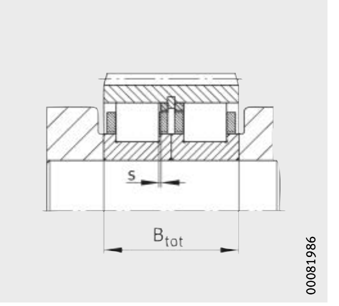
4) Tolerance for enveloping circle diameter E_w, see page 22.

5) The values for the spacing B_a relate to the recommended axial washers from Schaeffler.
If other axial washers are used, the condition $B_a = X + 2 \cdot B_{axial\ washer} + 0{,}2$ must be fulfilled.

Axial washers



For RN3..-E-MPBX (-EX-MPBX)



Axial clearance s

Dimension table · Dimensions in mm

Cylindrical roller bearing Designation	Axial washer Drawing number[2]	Mass m ≈g	Dimensions d	D	B	Axial clearance s min.	max.	Width between planet carriers B_{tot} min.	Retaining ring[1]
RN304-E-MPBX	–	2,6	**42,35**	45,5	1,5	0,4	0,9	30	SB45 1,5X2,3
RN305-E-MPBX	–	4,3	**50,65**	54	2	0,4	0,9	34	SB55 1,5X2,3
RN306-E-MPBX	–	7,6	**58,4**	62,5	2,5	0,4	0,9	38	SB63 1,5X2,3
RN307-E-MPBX	–	8,9	**65,96**	70,2	2,5	0,4	0,9	42	SB70 1,5X2,3
RN308-E-MPBX	–	12,7	**75,18**	80	2,75	0,4	0,9	46	SB80 2X2,8
RN309-E-MPBX	–	16,3	**83,4**	88,5	3	0,4	0,9	50	SB90 2,5X3,4
RN310-E-MPBX	–	21,8	**91,6**	97	3,5	0,4	0,9	54	SB97 2,5X3,4
RN311-E-MPBX	–	26,4	**100,6**	106,5	3,5	0,3	0,9	58	SB107 2,5X3,4
RN312-E-MPBX	–	34,3	**108,8**	115	4	0,3	0,9	62	SB115 2,5X3,4
RN313-E-MPBX	–	40,9	**117,6**	124,5	4	0,3	0,9	66	SB125 2,5X3,4
RN314-E-MPBX	–	45,4	**125,9**	133	4	0,3	0,9	70	SB133 2,5X3,4
RN315-E-MPBX	–	53	**135,3**	143	4	0,3	0,9	74	SB143 2,5X4
RN316-E-MPBX	–	65,4	**142,98**	151	4,5	0,3	0,9	78	SB153 2,5X4
RN317-E-MPBX	–	79,7	**151,7**	160	5	0,3	0,9	82	SB160 2,5X4
RN318-E-MPBX	–	90,7	**160,58**	169,5	5	0,3	0,9	86	SB170 2,5X4
RN319-E-MPBX	–	114,1	**168,58**	177,5	6	0,3	0,9	90	SB180 2,5X4
RN320-E-MPBX	–	133,5	**181,4**	191,5	5,75	0,3	0,9	94	SB190 3X5
RN322-E-MPBX	–	168,9	**200,3**	211	6,25	0,3	0,9	100	SB210 3X5
RN324-E-MPBX	–	220,9	**218,2**	230	6,75	0,3	0,9	110	SB230 3X5
RN326-E-MPBX	–	266,8	**234,6**	247	7,25	0,2	0,9	116	SB250 3X5
RN328-E-MPBX	–	318,5	**251**	264	7,75	0,2	0,9	124	SB270 4X7,5
RN330-E-MPBX	–	369,1	**269**	283	7,75	0,2	0,9	130	SB280 4X7,5
RN332-E-MPBX	–	413,6	**285,2**	300	7,75	0,2	0,9	136	SB300 4X7,5
RN334-E-MPBX	–	570,9	**300,9**	318	8,75	0,2	1	144	SB320 4X7,5
RN336-E-MPBX	–	592,8	**319,1**	335	9,25	0,2	1	150	SB340 4X7,5
RN338-E-MPBX	–	736	**335,2**	353	9,75	0,2	1,1	156	SB355 4X7,5
RN340-E-MPBX	–	823,1	**351**	370	9,75	0,2	1,1	160	SB370 4X7,5
RN344-EX-MPBX	–	1 090,2	**385,2**	406	10,75	0,2	1,1	176	SB410 4X7,5
RN348-EX-MPBX	–	1 291,4	**420,4**	442	10,75	0,2	1,1	190	SB440 4X7,5

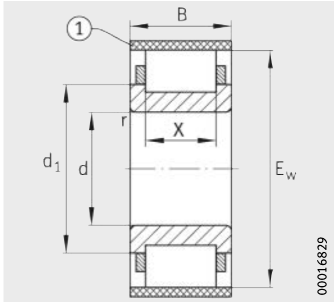
The dimension for axial location of the bearings must correspond to at least B_{tot}.
The tolerance for the spacing B_{tot} must therefore be +0,2 mm.

1) Not included in the scope of delivery.

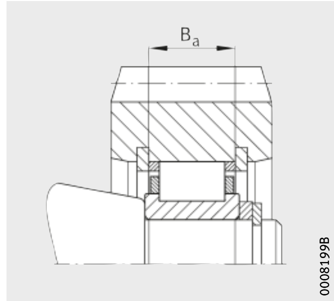
2) This will be determined once an order is placed.

Cylindrical roller bearings

With cage
Single row



RN22..-E-MPBX (-EX-MPBX)
1 Mounting sleeve



Mounting dimensions

Dimension table · Dimensions in mm

Designation[1) 2) 3)]		Mass	Dimensions					Mounting dimensions		Basic load ratings	
	X-life	m ≈kg	d	B	r min.	E_w[4)]	X	d_1	B_a[5)] +0,1	dyn. C_r N	stat. C_{0r} N
RN2204-E-MPBX	**XL**	0,097	**20**	18	1	41,5	11	29,7	16,2	38 500	31 000
RN2205-E-MPBX	**XL**	0,112	**25**	18	1	46,5	11	34,7	16,2	41 500	34 500
RN2206-E-MPBX	**XL**	0,177	**30**	20	1	55,5	13	41,3	18,2	57 000	50 000
RN2207-E-MPBX	**XL**	0,27	**35**	23	1,1	64	14	48	21,2	72 000	65 500
RN2208-E-MPBX	**XL**	0,34	**40**	23	1,1	71,5	15	54	21,2	83 000	75 000
RN2209-E-MPBX	**XL**	0,39	**45**	23	1,1	76,5	15	59	20,7	87 000	82 000
RN2210-E-MPBX	**XL**	0,41	**50**	23	1,1	81,5	15	64	20,7	92 000	88 000
RN2211-E-MPBX	**XL**	0,56	**55**	25	1,5	90	17	70,8	22,2	117 000	118 000
RN2212-E-MPBX	**XL**	0,6	**60**	28	1,5	100	20	77,6	25,2	151 000	153 000
RN2213-E-MPBX	**XL**	1,05	**65**	31	1,5	108,5	22	84,4	28,2	176 000	183 000
RN2214-E-MPBX	**XL**	1,11	**70**	31	1,5	113,5	22	89,4	28,2	184 000	196 000
RN2215-E-MPBX	**XL**	1,19	**75**	31	1,5	118,5	22	94,4	28,2	191 000	208 000
RN2216-E-MPBX	**XL**	1,48	**80**	33	2	127,3	24	101,5	30,2	220 000	245 000
RN2217-E-MPBX	**XL**	1,8	**85**	36	2	136,5	26	107,5	33,2	255 000	275 000
RN2218-E-MPBX	**XL**	2,26	**90**	40	2	145	28	114,3	37,2	285 000	315 000
RN2219-E-MPBX	**XL**	2,85	**95**	43	2,1	154,5	30	120,5	40,2	340 000	375 000
RN2220-E-MPBX	**XL**	3,43	**100**	46	2,1	163	34	127,3	43,2	395 000	445 000
RN2222-E-MPBX	**XL**	4,8	**110**	53	2,1	180,5	36	141,6	50,2	455 000	520 000
RN2224-E-MPBX	**XL**	6,52	**120**	58	2,1	195,5	40	153,2	54,7	530 000	610 000
RN2226-E-MPBX	**XL**	7,6	**130**	64	3	209,5	44	164	60,7	620 000	735 000
RN2228-E-MPBX	**XL**	9,19	**140**	68	3	225	44	179,4	64,7	670 000	830 000
RN2230-E-MPBX	**XL**	11,7	**150**	73	3	242	48	193,1	69,7	780 000	980 000
RN2232-E-MPBX	**XL**	15,2	**160**	80	3	259	55	205,5	75,7	940 000	1 180 000
RN2234-E-MPBX	**XL**	19,5	**170**	86	4	279	62	219	81,7	1 130 000	1 400 000
RN2236-E-MPBX	**XL**	20,5	**180**	86	4	289	62	229	81,7	1 180 000	1 500 000
RN2238-E-MPBX	–	24,4	**190**	92	4	306	65	242,7	87,7	1 100 000	1 660 000
RN2240-E-MPBX	–	29,2	**200**	98	4	323	70	256,3	93,7	1 220 000	1 860 000
RN2244-EX-MPBX	–	42,7	**220**	108	4	367	80	279,4	103,7	1 630 000	2 360 000
RN2248-EX-MPBX	–	55	**240**	120	4	399	85	312	115,7	1 830 000	2 800 000

1) Suitable axial washers, see page 51.

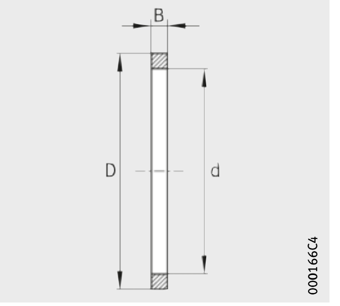
2) Internal clearance groups and tolerances, see page 23.

3) Depending on availability, one bearing can also be supplied with a cage of matching dimensions and the suffix MP1B.

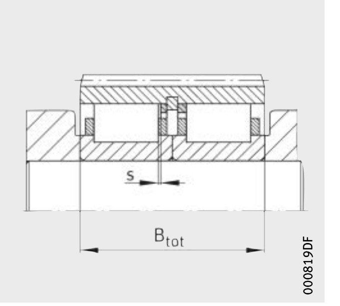
4) Tolerance for enveloping circle diameter E_w, see page 22.

5) The values for the spacing B_a relate to the recommended axial washers from Schaeffler. If other axial washers are used, the condition $B_a = X + 2 \cdot B_{axial\ washer} + 0{,}2$ must be fulfilled.

Axial washers



For RN22..-E-MPBX (-EX-MPBX)



Axial clearance s

Dimension table · Dimensions in mm

Cylindrical roller bearing	Axial washer							Width between planet carriers	Retaining ring[1]
Designation	Drawing number[2]	Mass	Dimensions			Axial clearance			
		m	d	D	B	s		B_{tot}	
		≈g				min.	max.	min.	
RN2204-E-MPBX	–	3,8	**38,45**	41,5	2,5	0,4	0,9	36	SB42 1,5X2,3
RN2205-E-MPBX	–	4,2	**43,45**	46,5	2,5	0,4	0,9	36	SB46 1,5X2,3
RN2206-E-MPBX	–	5,6	**52,1**	55,5	2,5	0,4	0,9	40	SB55 1,5X2,3
RN2207-E-MPBX	–	9,8	**60,36**	64	3,5	0,4	0,9	46	SB65 1,5X2,3
RN2208-E-MPBX	–	10,1	**67,56**	71,5	3	0,4	0,9	46	SB72 1,5X2,3
RN2209-E-MPBX	–	9,9	**72,6**	76,5	2,75	0,4	0,9	46	SB76 2X2,8
RN2210-E-MPBX	–	10,6	**77,58**	81,5	2,75	0,4	0,9	46	SB81 2X2,8
RN2211-E-MPBX	–	11,2	**85,88**	90	2,5	0,3	0,9	50	SB90 2,5X3,4
RN2212-E-MPBX	–	14,4	**95,22**	100	2,5	0,3	0,9	56	SB100 2,5X3,4
RN2213-E-MPBX	–	19,7	**103,48**	108,5	3	0,3	0,9	62	SB108 2,5X3,4
RN2214-E-MPBX	–	20,8	**108,44**	113,5	3	0,3	0,9	62	SB113 2,5X3,4
RN2215-E-MPBX	–	21,7	**113,44**	118,5	3	0,3	0,9	62	SB118 2,5X3,4
RN2216-E-MPBX	–	24,7	**121,94**	127,3	3	0,3	0,9	66	SB127 2,5X3,4
RN2217-E-MPBX	–	34,1	**130,6**	136,5	3,5	0,3	0,9	72	SB137 2,5X3,4
RN2218-E-MPBX	–	48,9	**138,78**	145	4,5	0,3	0,9	80	SB143 2,5X4
RN2219-E-MPBX	–	63,5	**147,68**	154,5	5	0,3	0,9	86	SB153 2,5X4
RN2220-E-MPBX	–	63	**155,88**	163	4,5	0,3	0,9	92	SB163 2,5X4
RN2222-E-MPBX	–	117,6	**172,78**	180,5	7	0,3	0,9	106	SB180 2,5X4
RN2224-E-MPBX	–	142,2	**187,18**	195,5	7,25	0,3	0,9	116	SB195 3X5
RN2226-E-MPBX	F-585099	184,7	**200,64**	209,5	8,25	0,2	0,9	128	SB210 3X5
RN2228-E-MPBX	–	248	**216,1**	225	10,25	0,2	0,9	136	SB225 3X5
RN2230-E-MPBX	–	295,5	**232,6**	242	10,75	0,2	0,9	146	SB240 3X5
RN2232-E-MPBX	–	324	**248,9**	259	10,25	0,2	1	160	SB260 4X7,5
RN2234-E-MPBX	–	368	**267,8**	279	9,75	0,2	1	172	SB280 4X7,5
RN2236-E-MPBX	–	378,1	**277,9**	289	9,75	0,2	1	172	SB290 4X7,5
RN2238-E-MPBX	–	486,9	**294,3**	306	11,25	0,2	1,1	184	SB310 4X7,5
RN2240-E-MPBX	–	564,4	**310,7**	323	11,75	0,2	1,1	196	SB325 4X7,5
RN2244-EX-MPBX	–	912,9	**349,4**	367	11,75	0,2	1,1	216	SB370 4X7,5
RN2248-EX-MPBX	–	1 340,9	**380,7**	399	15,25	0,2	1,1	240	SB400 4X7,5

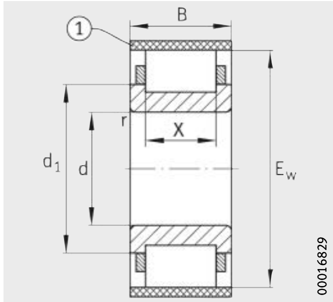
The dimension for axial location of the bearings must correspond to at least B_{tot}.
The tolerance for the spacing B_{tot} must therefore be +0,2 mm.

[1] Not included in the scope of delivery.

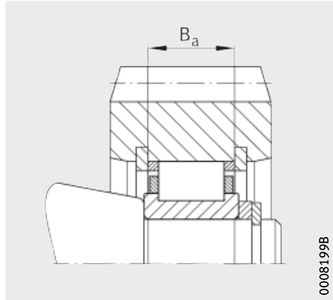
[2] This will be determined once an order is placed.

Cylindrical roller bearings

With cage
Single row



RN23..-E-MPBX (-EX-MPBX)
1 Mounting sleeve



Mounting dimensions

Dimension table · Dimensions in mm

Designation[1) 2) 3)]		Mass	Dimensions					Mounting dimensions		Basic load ratings	
	X-life	m	d	B	r	E_w[4)]	X	d_1	B_a[5)]	dyn. C_r	stat. C_{0r}
		≈kg			min.				+0,1	N	N
RN2304-E-MPBX	**XL**	0,144	**20**	21	1,1	45,5	14	31,1	19,2	48 500	39 000
RN2305-E-MPBX	**XL**	0,231	**25**	24	1,1	54	16	38,1	22,2	66 000	56 000
RN2306-E-MPBX	**XL**	0,345	**30**	27	1,1	62,5	18	45	25,2	86 000	75 000
RN2307-E-MPBX	**XL**	0,48	**35**	31	1,5	70,2	21	51	29,2	108 000	98 000
RN2308-E-MPBX	**XL**	0,67	**40**	33	1,5	80	22	57,6	30,7	132 000	120 000
RN2309-E-MPBX	**XL**	0,89	**45**	36	1,5	88,5	24	64,4	33,2	162 000	153 000
RN2310-E-MPBX	**XL**	1,18	**50**	40	2	97	27	71,3	37,2	192 000	187 000
RN2311-E-MPBX	**XL**	1,56	**55**	43	2	106,5	30	77,5	40,2	235 000	230 000
RN2312-E-MPBX	**XL**	1,92	**60**	46	2,1	115	32	84,4	43,2	265 000	260 000
RN2313-E-MPBX	**XL**	2,31	**65**	48	2,1	124,5	32	90,5	45,2	295 000	285 000
RN2314-E-MPBX	**XL**	2,78	**70**	51	2,1	133	34	97,4	48,2	325 000	325 000
RN2315-E-MPBX	**XL**	3,54	**75**	55	2,1	143	38	104,1	52,2	390 000	395 000
RN2316-E-MPBX	**XL**	4,1	**80**	58	2,1	151	40	110,4	55,2	420 000	425 000
RN2317-E-MPBX	**XL**	4,77	**85**	60	3	160	40	117,8	57,2	460 000	480 000
RN2318-E-MPBX	**XL**	5,71	**90**	64	3	169,5	44	124	61,2	510 000	530 000
RN2319-E-MPBX	**XL**	6,46	**95**	67	3	177,5	44	132	64,2	540 000	585 000
RN2320-E-MPBX	**XL**	8,61	**100**	73	3	191,5	52	139,4	69,7	680 000	720 000
RN2322-E-MPBX	**XL**	11,4	**110**	80	3	211	55	155,6	76,7	790 000	870 000
RN2324-E-MPBX	**XL**	14,7	**120**	86	3	230	62	168,7	82,7	930 000	1 020 000
RN2326-E-MPBX	**XL**	18,1	**130**	93	4	247	65	181,7	89,7	1 080 000	1 220 000
RN2328-E-MPBX	**XL**	22,4	**140**	102	4	264	70	195,4	97,7	1 210 000	1 400 000
RN2330-E-MPBX	**XL**	27,4	**150**	108	4	283	75	209,5	103,7	1 380 000	1 600 000
RN2332-EX-MPBX	–	32,4	**160**	114	4	300	80	221,6	109,7	1 320 000	1 830 000
RN2334-EX-MPBX	–	39,4	**170**	120	4	320	85	235,7	115,7	1 500 000	2 080 000
RN2336-EX-MPBX	–	46,6	**180**	126	4	339	90	248	121,7	1 660 000	2 320 000
RN2338-EX-MPBX	–	58,3	**190**	132	5	360	95	262,5	127,7	1 900 000	2 650 000
RN2340-EX-MPBX	–	66,2	**200**	138	5	377	100	276,1	133,7	2 040 000	2 900 000
RN2344-EX-MPBX	–	85,3	**220**	145	5	413	105	302,2	140,7	2 360 000	3 350 000
RN2348-EX-MPBX	–	96,2	**240**	155	5	447	110	329,6	150,7	2 600 000	3 750 000

1) Suitable axial washers, see page 53.

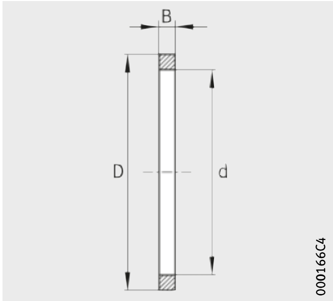
2) Internal clearance groups and tolerances, see page 23.

3) Depending on availability, one bearing can also be supplied with a cage of matching dimensions and the suffix MP1B.

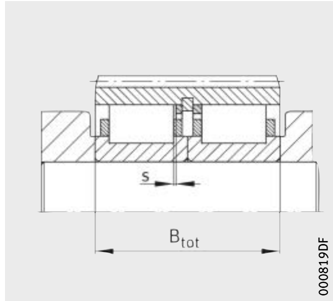
4) Tolerance for enveloping circle diameter E_w, see page 22.

5) The values for the spacing B_a relate to the recommended axial washers from Schaeffler. If other axial washers are used, the condition $B_a = X + 2 \cdot B_{axial\ washer} + 0{,}2$ must be fulfilled.

Axial washers



For RN23..-E-MPBX (-EX-MPBX)



Axial clearance s

Dimension table · Dimensions in mm

Cylindrical roller bearing	Axial washer							Width between planet carriers	Retaining ring[1]
Designation	Drawing number[2]	Mass	Dimensions			Axial clearance			
		m	d	D	B	s		B_{tot}	
		≈g				min.	max.	min.	
RN2304-E-MPBX	–	4,3	**42,35**	45,5	2,5	0,4	0,9	42	SB45 1,5X2,3
RN2305-E-MPBX	–	6,5	**50,65**	54	3	0,4	0,9	48	SB55 1,5X2,3
RN2306-E-MPBX	–	10,7	**58,4**	62,5	3,5	0,4	0,9	54	SB63 1,5X2,3
RN2307-E-MPBX	–	14,2	**65,96**	70,2	4	0,3	0,9	62	SB70 1,5X2,3
RN2308-E-MPBX	F-589254	19,6	**75,18**	80	4,25	0,3	0,9	66	SB80 2X2,8
RN2309-E-MPBX	–	24,4	**83,38**	88,5	4,5	0,3	0,9	72	SB90 2,5X3,4
RN2310-E-MPBX	F-589253	31,2	**91,64**	97	5	0,3	0,9	80	SB97 2,5X3,4
RN2311-E-MPBX	–	37,8	**100,58**	106,5	5	0,3	0,9	86	SB107 2,5X3,4
RN2312-E-MPBX	–	47,2	**108,78**	115	5,5	0,3	0,9	92	SB115 2,5X3,4
RN2313-E-MPBX	–	66,5	**117,64**	124,5	6,5	0,3	0,9	96	SB125 2,5X3,4
RN2314-E-MPBX	–	79,5	**125,88**	133	7	0,3	0,9	102	SB133 2,5X3,4
RN2315-E-MPBX	–	92,7	**135,28**	143	7	0,3	0,9	110	SB143 2,5X4
RN2316-E-MPBX	–	109	**142,98**	151	7,5	0,3	0,9	116	SB153 2,5X4
RN2317-E-MPBX	–	135,5	**151,7**	160	8,5	0,3	0,9	120	SB160 2,5X4
RN2318-E-MPBX	–	154,2	**160,58**	169,5	8,5	0,3	0,9	128	SB170 2,5X4
RN2319-E-MPBX	–	190,2	**168,58**	177,5	10	0,3	0,9	134	SB180 2,5X4
RN2320-E-MPBX	–	203,1	**181,4**	191,5	8,75	0,3	1	146	SB190 3X5
RN2322-E-MPBX	–	290,5	**200,34**	211	10,75	0,3	1	160	SB210 3X5
RN2324-E-MPBX	–	335,4	**218,15**	230	10,25	0,3	1	172	SB230 3X5
RN2326-E-MPBX	–	450,8	**234,6**	247	12,25	0,2	1	186	SB250 3X5
RN2328-E-MPBX	–	565,1	**251,05**	264	13,75	0,2	1	204	SB270 4X7,5
RN2330-E-MPBX	–	678,6	**269**	283	14,25	0,2	1	216	SB280 4X7,5
RN2332-EX-MPBX	–	787,2	**285,2**	300	14,75	0,2	1	228	SB300 4X7,5
RN2334-EX-MPBX	–	1 035,1	**302,3**	320	15,25	0,2	1	240	SB320 4X7,5
RN2336-EX-MPBX	–	1 215,2	**320**	339	15,75	0,2	1	252	SB340 4X7,5
RN2338-EX-MPBX	–	1 422,3	**339,7**	360	16,25	0,2	1,1	264	SB360 4X7,5
RN2340-EX-MPBX	–	1 581,5	**356,1**	377	16,75	0,2	1,1	276	SB380 4X7,5
RN2344-EX-MPBX	–	1 994,5	**390,3**	413	17,75	0,2	1,1	290	SB415 4X7,5
RN2348-EX-MPBX	–	2 595	**423,1**	447	20,25	0,2	1,1	310	SB450 4X7,5

The dimension for axial location of the bearings must correspond to at least B_{tot}.
The tolerance for the spacing B_{tot} must therefore be +0,2 mm.

[1] Not included in the scope of delivery.

[2] This will be determined once an order is placed.

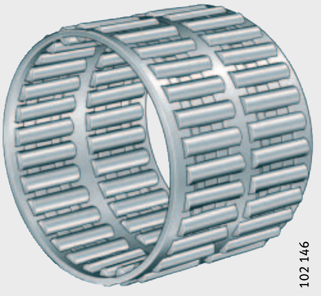
Product overview Needle roller and cage assemblies

Single row

K

Double row

K..-ZW



Single row

Externally guided

KZK

Needle roller and cage assemblies

Features

Needle roller and cage assemblies are single or double row units comprising cages and needle rollers. The single row design is based on DIN 5405-1.

The cages are made from quenched and tempered steel, have good wear resistance, have high strength and their large guidance surfaces are designed for optimum lubrication. Plastic cages are only available for certain sizes. Bearings with these cages have the suffix TV.

Needle roller and cage assemblies require very little radial space since the radial section height corresponds precisely to the diameter of the needle rollers.

Needle roller and cage assemblies give bearing arrangements with high runout accuracy, which is influenced by the geometrical accuracy of the raceways.

The radial internal clearance is dependent on the needle sort as well as the shaft and housing tolerances and can be adjusted by means of the needle roller sort.

Double row needle roller and cage assemblies are only available in particular enveloping circle diameters F_W.

The further information on needle roller and cage assemblies in Catalogue HR 1, Rolling Bearings, as well as in Technical Product Information TPI 94, Needle Roller and Cage Assemblies for Crank Pins and Piston Pins must be noted.

Needle rollers

Needle roller and cage assemblies are supplied with standard needle roller sorts, see table.

A needle roller and cage assembly contains needle rollers of one sort only. The sort is printed on the packaging and is colour coded.

Standard needle roller sorts

Sort pair Colour coding	Needle roller sort µm
Red	0 –2 / –1 –3
Blue	–2 –4 / –3 –5
White (grey)	–4 –6 / –5 –7

External guidance

Needle roller and cage assemblies KZK (for example for crank pins) are externally guided, which means that the cage is radially guided with little clearance by the bore.

The radial movement of the cage relative to the bore and the rolling elements is as small as possible.

Operating temperature

Needle roller and cage assemblies with a plastic cage can be used at operating temperatures from –20 °C to +120 °C.

Design and safety guidelines

Design of adjacent parts

The bores and pins for the needle roller and cage assemblies must be produced as rolling bearing raceways. The roughness must be Ra 0,2 (Rz 1). The roundness and parallelism of the raceways should be IT3.

The rolling bearing raceways should be designed as follows:

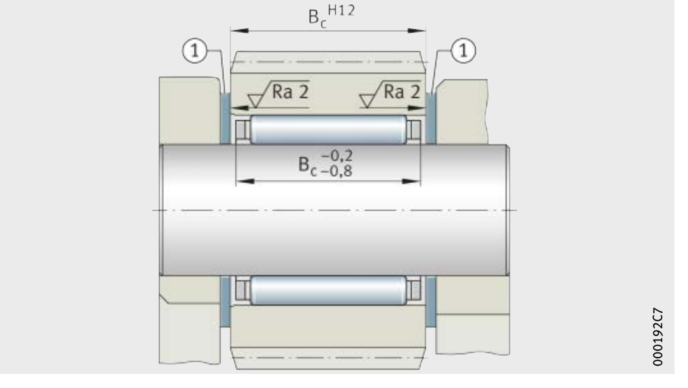
- Case hardened to at least 0,3 mm deep;
  the surface hardness must be at least 670 HV + 170 HV.
- The lateral running surfaces must be precision machined (Ra 2 recommended) and wear-resistant;
  axial washers should be fitted if necessary.

!

Axial washers and shaft shoulders should be produced as wear-resistant surfaces, for example by hardening.

Raceway width

The raceway width must be at least equal to the cage width B_c (B_c is produced with a minus (–) tolerance); values for B_c, see dimension tables. The distance between the axial limit surfaces should therefore be toleranced to H12, *Figure 1*. The axial running surfaces for the needle roller and cage assemblies must be precision machined (Ra 2 recommended) and wear-resistant.



1 Axial washer

B_c = cage width
Ra = surface roughness

Figure 1
Raceway width and axial running surfaces

Axial location

Needle roller and cage assemblies must be axially located by means of an appropriate adjacent construction design. If location is by means of snap rings or retaining rings, an axial washer must be arranged in each case between the rings and the needle roller and cage assembly. It must be ensured that there is sufficient interference between the ring and the washer. Planetary gears must be axially located directly on the adjacent construction by means of axial washers, *Figure 1*, page 56.

Radial internal clearance

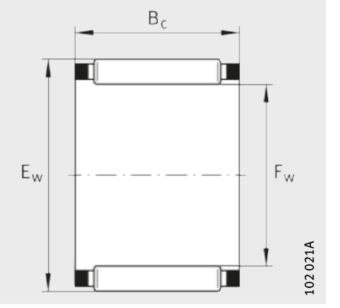
The radial internal clearance is dependent on the speed, rigidity and accuracy of the adjacent parts. This can be determined by sorting of the needle sort. For simplification, the mean values of the needle roller sorts can be used.

Example

Determining the radial internal clearance using the mean value of the needle roller sort: needle roller sort 0 –2, mean value –1.

Needle roller and cage assemblies

Single row



K..-TV

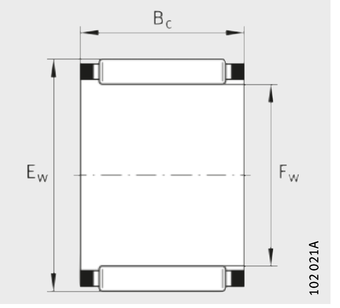
Dimension table · Dimensions in mm

Designation	Mass	Dimensions			Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
	m	F_w	E_w	B_c	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
	≈g				N	N	N	min^{-1}	min^{-1}
K3X5X7-TV	0,3	**3**	5	7	1 540	1 290	152	50 000	78 000
K3X5X9-TV	0,4	**3**	5	9	1 710	1 480	188	50 000	80 000
K3X6X7-TV	0,4	**3**	6	7	1 430	970	109	47 000	75 000
K4X7X7-TV	0,5	**4**	7	7	1 740	1 270	145	42 500	59 000
K4X7X10-TV	0,7	**4**	7	10	2 330	1 840	236	42 500	59 000
K5X8X8-TV	0,7	**5**	8	8	2 350	1 920	237	39 000	48 000
K5X8X10-TV	0,9	**5**	8	10	3 000	2 650	350	39 000	47 000
K6X9X8-TV	0,8	**6**	9	8	2 600	2 280	285	36 500	41 000
K6X9X10-TV	1	**6**	9	10	3 350	3 150	420	36 500	40 000
K6X10X13-TV	1	**6**	10	13	3 800	3 100	395	35 500	40 000
K7X9X7-TV	0,6	**7**	9	7	1 730	1 770	215	35 500	40 000
K7X10X8-TV	0,9	**7**	10	8	2 850	2 650	330	34 500	36 000
K7X10X10-TV	1	**7**	10	10	3 650	3 600	485	34 500	35 000
K8X11X8-TV	1,1	**8**	11	8	3 100	3 000	375	32 500	32 000
K8X11X10-TV	1,2	**8**	11	10	3 950	4 100	560	32 500	31 000
K8X11X13-TV	1,7	**8**	11	13	5 100	5 800	790	32 500	30 500
K8X12X10-TV	2	**8**	12	10	5 000	4 700	560	31 500	29 000
K9X12X10-TV	2	**9**	12	10	4 500	5 000	680	31 000	27 500
K9X12X13-TV	2,1	**9**	12	13	5 900	7 100	970	31 000	27 000
K10X13X10-TV	2	**10**	13	10	4 750	5 500	750	29 500	24 900
K10X13X13-TV	2	**10**	13	13	6 200	7 800	1 060	29 500	24 400
K10X13X16-TV	2,9	**10**	13	16	7 100	9 300	1 310	29 500	24 600
K10X14X10-TV	2,5	**10**	14	10	5 800	6 000	720	29 000	23 500
K10X14X13-TV	4,6	**10**	14	13	7 500	8 400	1 020	29 000	23 000
K10X16X12-TV	5	**10**	16	12	8 100	7 200	1 000	27 500	21 800
K12X15X10-TV	2,9	**12**	15	10	4 900	6 100	830	27 000	21 500
K12X15X13-TV	2,3	**12**	15	13	6 400	8 500	1 170	27 000	21 100
K12X16X13-TV	3,6	**12**	16	13	8 000	9 400	1 150	26 500	19 900
K12X17X13-TV	4,9	**12**	17	13	9 600	10 400	1 330	26 500	18 800
K12X18X12-TV	6	**12**	18	12	10 000	9 900	1 400	26 000	18 100

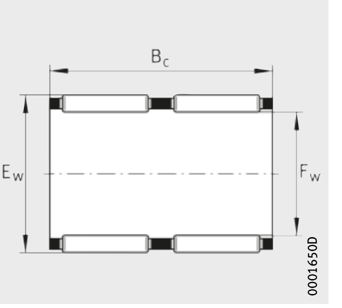
Dimension table (continued) · Dimensions in mm									
Designation	Mass	Dimensions			Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
	m	F_w	E_w	B_c	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
	≈g				N	N	N	min^{-1}	min^{-1}
K14X18X10	4	**14**	18	10	7 100	8 500	1 060	25 000	17 300
K14X18X13	6,5	**14**	18	13	8 200	10 100	1 320	25 000	17 700
K14X18X15-TV	5	**14**	18	15	9 500	12 300	1 540	25 000	17 400
K14X18X17	8	**14**	18	17	10 800	14 400	1 890	25 000	17 300
K14X20X12	8,5	**14**	20	12	10 300	10 600	1 490	24 300	16 200
K15X18X17-TV	4,6	**15**	18	17	8 000	12 100	1 730	24 600	17 700
K15X19X10	5,1	**15**	19	10	7 500	9 200	1 140	24 300	16 200
K15X19X13	7	**15**	19	13	8 500	10 900	1 420	24 300	16 600
K15X19X17	9,5	**15**	19	17	11 300	15 600	2 040	24 300	16 200
K15X20X13	7	**15**	20	13	9 900	11 500	1 430	23 900	15 900
K15X21X15	11	**15**	21	15	14 300	16 400	2 210	23 600	14 700
K15X21X21	17	**15**	21	21	19 400	24 300	3 300	23 600	14 400
K16X20X10	5	**16**	20	10	7 800	9 900	1 230	23 600	15 200
K16X20X13	8	**16**	20	13	8 900	11 800	1 530	23 600	15 600
K16X20X17	10,4	**16**	20	17	11 700	16 800	2 190	23 600	15 200
K16X22X12	10	**16**	22	12	11 500	12 500	1 780	22 900	14 300
K16X22X16	12	**16**	22	16	14 800	17 500	2 390	22 900	14 100
K16X22X20	15	**16**	22	20	18 300	22 800	3 050	22 900	14 000
K16X24X20	22	**16**	24	20	21 400	23 500	2 950	22 400	13 200
K17X21X10	5	**17**	21	10	8 100	10 600	1 310	22 900	14 400
K17X21X13	6,5	**17**	21	13	10 400	14 600	1 810	22 900	14 100
K17X21X17	9,5	**17**	21	17	12 200	17 900	2 350	22 900	14 400
K18X22X10	6	**18**	22	10	8 400	11 300	1 400	22 400	13 600
K18X22X13	8	**18**	22	13	9 200	12 700	1 650	22 400	14 200
K18X22X17	11	**18**	22	17	12 100	18 000	2 360	22 400	13 900
K18X24X12	12	**18**	24	12	12 800	14 900	2 120	21 800	12 700
K18X24X13	13	**18**	24	13	13 100	15 300	1 990	21 800	12 900
K18X24X20	18	**18**	24	20	20 200	27 000	3 550	21 800	12 400
K18X25X22	23	**18**	25	22	23 100	29 000	3 750	21 600	12 200
K19X23X13	8	**19**	23	13	9 500	13 500	1 750	21 800	13 500
K19X23X17	11	**19**	23	17	12 500	19 200	2 500	21 800	13 200

Needle roller and cage assemblies

Single row
Double row



K, K..-TV



K..-ZW

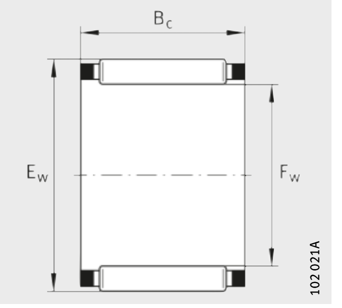
Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions			Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
	m	F_w	E_w	B_c	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
	≈g				N	N	N	min^{-1}	min^{-1}
K20X24X10	7	**20**	24	10	8 900	12 600	1 570	21 300	12 400
K20X24X13	9	**20**	24	13	9 800	14 300	1 860	21 300	12 800
K20X24X17	13	**20**	24	17	12 900	20 400	2 650	21 300	12 500
K20X26X12	12	**20**	26	12	13 400	16 200	2 310	20 900	11 700
K20X26X13	12	**20**	26	13	14 400	17 900	2 330	20 900	11 600
K20X26X17	16	**20**	26	17	19 200	26 000	3 300	20 900	11 200
K20X26X20	19	**20**	26	20	21 100	29 000	3 900	20 900	11 400
K20X28X16	20	**20**	28	16	19 800	22 400	3 000	20 400	11 100
K20X28X20	27	**20**	28	20	23 900	28 500	3 600	20 400	11 100
K20X28X25	32	**20**	28	25	30 500	39 000	5 300	20 400	10 800
K20X30X30	49	**20**	30	30	35 500	41 500	5 500	19 600	10 800
K21X25X13	9	**21**	25	13	10 100	15 100	1 970	20 900	12 300
K22X26X10	8	**22**	26	10	9 100	13 400	1 670	20 400	11 500
K22X26X13	10	**22**	26	13	10 400	15 900	2 080	20 400	11 800
K22X26X17	12,1	**22**	26	17	13 700	22 700	3 000	20 400	11 500
K22X28X17	18	**22**	28	17	19 400	27 000	3 450	19 600	10 500
K22X29X16	16	**22**	29	16	20 000	25 500	3 350	19 200	10 300
K22X30X15-TV	18	**22**	30	15	20 100	23 400	3 050	18 800	10 200
K22X32X24	43	**22**	32	24	34 000	40 000	4 900	18 100	9 700
K23X35X16-TV	29	**23**	35	16	24 500	23 900	2 950	16 900	9 500
K24X28X10	9	**24**	28	10	9 600	14 800	1 840	18 800	10 600
K24X28X13	12	**24**	28	13	11 000	17 600	2 290	18 800	10 800
K24X28X17	13	**24**	28	17	14 500	25 000	3 300	18 800	10 600
K24X30X17	20	**24**	30	17	19 500	27 500	3 500	18 100	10 000
K24X30X31-ZW	32	**24**	30	31	27 500	43 500	5 800	18 100	10 400

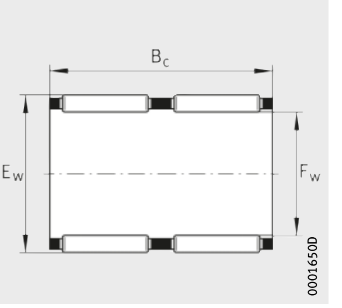
Dimension table (continued) · Dimensions in mm									
Designation	Mass	Dimensions			Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
	m	F_w	E_w	B_c	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
	≈g				N	N	N	min^{-1}	min^{-1}
K25X29X10	7	**25**	29	10	9 900	15 400	1 930	18 100	10 200
K25X29X13	11	**25**	29	13	11 300	18 400	2 400	18 100	10 400
K25X29X17	14	**25**	29	17	14 900	26 000	3 450	18 100	10 200
K25X30X17	16	**25**	30	17	18 700	30 000	3 850	17 800	9 600
K25X30X20	18	**25**	30	20	21 700	36 500	4 850	17 800	9 500
K25X30X26-ZW	19	**25**	30	26	21 400	35 500	4 500	17 800	10 400
K25X31X17	19	**25**	31	17	19 600	28 500	3 600	17 500	9 600
K25X31X21	20	**25**	31	21	24 700	38 000	5 100	17 500	9 400
K25X32X16	21	**25**	32	16	20 800	27 500	3 650	17 200	9 400
K25X33X20	34	**25**	33	20	28 500	38 000	4 850	16 900	9 000
K25X33X24	39	**25**	33	24	34 000	47 000	6 300	16 900	8 900
K25X35X30	65	**25**	35	30	47 000	62 000	8 300	16 300	8 500
K26X30X13	11	**26**	30	13	11 600	19 200	2 500	17 500	10 100
K26X30X17	15	**26**	30	17	15 200	27 500	3 600	17 500	9 800
K26X30X22-ZW	21	**26**	30	22	15 700	28 500	3 550	17 500	10 400
K28X33X13	14	**28**	33	13	15 300	24 200	3 100	16 100	8 900
K28X33X17	17	**28**	33	17	19 700	33 500	4 250	16 100	8 700
K28X34X17	24	**28**	34	17	21 800	33 500	4 300	15 800	8 600
K28X35X16	24	**28**	35	16	21 500	29 500	3 950	15 600	8 700
K28X35X18	29	**28**	35	18	24 000	34 000	4 700	15 600	8 600
K28X40X25	72	**28**	40	25	45 500	55 000	6 600	14 400	7 700
K30X34X13	14	**30**	34	13	12 300	21 700	2 850	15 300	8 900
K30X35X13	14	**30**	35	13	15 600	25 500	3 250	15 100	8 400
K30X35X17	19	**30**	35	17	19 600	34 000	4 300	15 100	8 300
K30X35X27	30	**30**	35	27	30 500	59 000	8 500	15 100	8 100
K30X37X16	27	**30**	37	16	23 100	33 500	4 450	14 600	8 000
K30X37X18	30	**30**	37	18	26 000	38 500	5 300	14 600	8 000
K30X40X18	48	**30**	40	18	32 000	40 000	5 000	14 000	7 600
K30X40X30	73	**30**	40	30	49 000	69 000	9 200	14 000	7 500

Needle roller and cage assemblies

Single row
Double row



K



K..-ZW, K..-ZW-TV

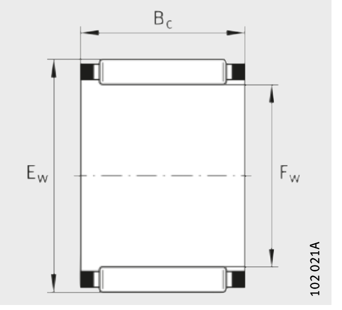
Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions			Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
	m	F_w	E_w	B_c	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
	≈g				N	N	N	min^{-1}	min^{-1}
K32X37X13	19	**32**	37	13	15 500	25 500	3 300	14 200	8 100
K32X37X17	19	**32**	37	17	19 900	35 500	4 500	14 200	7 900
K32X37X27	30	**32**	37	27	30 000	60 000	8 500	14 200	7 800
K32X38X20	30	**32**	38	20	26 500	45 000	6 000	14 000	7 700
K32X39X16	29	**32**	39	16	23 800	35 500	4 700	13 800	7 600
K32X39X18	31	**32**	39	18	26 500	41 000	5 200	13 800	7 500
K32X40X25	50	**32**	40	25	37 500	58 000	7 900	13 600	7 400
K32X40X42-ZW-TV	65	**32**	40	42	50 000	84 000	10 500	13 600	7 800
K32X46X32	119	**32**	46	32	66 000	84 000	11 100	12 600	6 700
K35X40X13	19	**35**	40	13	16 200	28 000	3 600	13 100	7 500
K35X40X17	21	**35**	40	17	20 800	38 500	4 900	13 100	7 400
K35X40X25	31	**35**	40	25	29 500	60 000	8 400	13 100	7 200
K35X40X27-TV	39	**35**	40	27	25 000	48 500	6 700	13 100	7 900
K35X42X16	34	**35**	42	16	24 400	37 500	5 000	12 700	7 100
K35X42X18	34	**35**	42	18	27 500	43 000	6 000	12 700	7 100
K35X42X20	40	**35**	42	20	30 000	49 000	6 200	12 700	7 000
K35X42X30	67	**35**	42	30	39 000	68 000	9 400	12 700	7 200
K35X45X20	56	**35**	45	20	37 000	50 000	6 500	12 300	6 800
K35X45X30	80	**35**	45	30	53 000	79 000	10 500	12 300	6 700
K37X42X17	23	**37**	42	17	22 400	43 000	5 500	12 400	6 900
K38X43X17	29	**38**	43	17	20 500	38 500	4 850	12 100	7 000
K38X43X27	43	**38**	43	27	31 500	68 000	9 600	12 100	6 800
K38X46X20	51	**38**	46	20	35 500	57 000	7 200	11 700	6 300
K38X46X32	76	**38**	46	32	55 000	99 000	14 200	11 700	6 200
K39X44X26-ZW	45	**39**	44	26	27 500	56 000	7 100	11 800	7 000

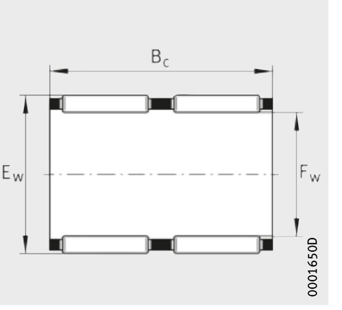
Dimension table (continued) · Dimensions in mm									
Designation	Mass	Dimensions			Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
	m	F_w	E_w	B_c	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
	≈g				N	N	N	min^{-1}	min^{-1}
K40X45X13	19	**40**	45	13	17 600	32 500	3 900	11 500	6 600
K40X45X17	31	**40**	45	17	21 400	41 500	5 200	11 500	6 700
K40X45X27	46	**40**	45	27	33 000	73 000	10 300	11 500	6 500
K40X47X18	39	**40**	47	18	29 500	50 000	6 900	11 300	6 300
K40X47X20	42	**40**	47	20	32 500	57 000	7 200	11 300	6 200
K40X48X20	49	**40**	48	20	36 000	59 000	7 500	11 100	6 100
K42X47X13	18	**42**	47	13	17 800	33 500	4 350	11 000	6 400
K42X47X17	32	**42**	47	17	21 700	43 000	5 400	11 000	6 400
K42X47X30-ZW	54	**42**	47	30	33 500	76 000	10 000	11 000	6 400
K42X50X20	53	**42**	50	20	35 000	57 000	7 300	10 700	6 000
K43X48X17	30	**43**	48	17	21 600	43 000	5 400	10 800	6 300
K43X48X27	50	**43**	48	27	33 500	75 000	10 700	10 800	6 200
K45X50X17	34	**45**	50	17	22 500	46 000	5 800	10 300	6 100
K45X50X27	52	**45**	50	27	34 500	80 000	11 400	10 300	5 900
K45X52X18	42	**45**	52	18	31 500	57 000	7 900	10 100	5 700
K45X53X20	55	**45**	53	20	39 000	67 000	8 700	10 000	5 500
K45X53X21	60	**45**	53	21	38 500	67 000	8 600	10 000	5 600
K45X53X28	80	**45**	53	28	52 000	98 000	13 700	10 000	5 400
K45X59X18-TV	72	**45**	59	18	44 500	54 000	6 900	9 400	5 400
K45X59X32	148	**45**	59	32	73 000	103 000	13 800	9 400	5 300
K47X52X17	35	**47**	52	17	23 300	49 000	6 100	9 900	5 800
K47X52X27	51	**47**	52	27	35 000	83 000	11 800	9 900	5 700

Needle roller and cage assemblies

Single row
Double row



K



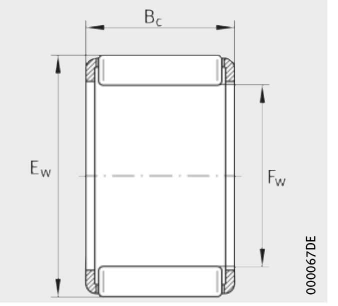
K..-ZW

Dimension table (continued) · Dimensions in mm

Designation	Mass	Dimensions			Basic load ratings		Fatigue limit load	Limiting speed	Reference speed
	m	F_w	E_w	B_c	dyn. C_r	stat. C_{0r}	C_{ur}	n_G	n_B
	≈g				N	N	N	min^{-1}	min^{-1}
K50X55X13,5	30	**50**	55	13,5	18 200	36 500	4 600	9 300	5 700
K50X55X17	35	**50**	55	17	26 000	57 000	7 300	9 300	5 700
K50X55X20	45	**50**	55	20	26 500	60 000	7 800	9 300	5 500
K50X55X30	65	**50**	55	30	39 000	97 000	13 900	9 300	5 400
K50X57X18	47	**50**	57	18	33 500	63 000	8 800	9 200	5 200
K50X58X20	75	**50**	58	20	35 500	62 000	8 800	9 100	5 400
K50X58X25	90	**50**	58	25	44 000	81 000	10 800	9 100	5 300
K52X57X12	24	**52**	57	12	18 000	36 500	4 600	9 000	5 400
K55X60X20	40	**55**	60	20	28 500	66 000	8 600	8 500	5 100
K55X60X27	69	**55**	60	27	38 000	97 000	13 600	8 500	4 950
K55X60X30	72	**55**	60	30	41 000	108 000	15 400	8 500	4 950
K55X62X18	52	**55**	62	18	35 500	70 000	9 800	8 400	4 750
K55X63X20	67	**55**	63	20	40 000	74 000	9 500	8 300	4 800
K55X63X25	80	**55**	63	25	50 000	100 000	13 700	8 300	4 700
K55X63X32	102	**55**	63	32	62 000	130 000	18 600	8 300	4 650
K58X65X18	79	**58**	65	18	35 000	70 000	9 800	8 000	4 650
K58X65X36-ZW	127	**58**	65	36	49 000	107 000	14 600	8 000	5 100
K60X65X20	52	**60**	65	20	29 500	72 000	9 300	7 800	4 750
K60X65X30	77	**60**	65	30	42 500	116 000	16 600	7 800	4 650
K60X66X33-ZW	104	**60**	66	33	46 000	112 000	15 100	7 800	4 800
K60X66X40-ZW	147	**60**	66	40	58 000	151 000	19 900	7 800	4 650
K60X68X20	71	**60**	68	20	43 500	85 000	11 000	7 700	4 400
K60X68X23	94	**60**	68	23	49 500	101 000	13 500	7 700	4 350
K60X68X25	89	**60**	68	25	53 000	111 000	15 200	7 700	4 350
K60X68X30-ZW	129	**60**	68	30	44 500	88 000	11 300	7 700	4 950
K60X75X42	240	**60**	75	42	118 000	199 000	27 000	7 300	4 050
K62X70X40-ZW	174	**62**	70	40	66 000	146 000	20 500	7 400	4 550
K64X70X16	53	**64**	70	16	28 000	60 000	8 100	7 300	4 500

Needle roller and cage assemblies

Single row
Externally guided



KZK

Dimension table · Dimensions in mm

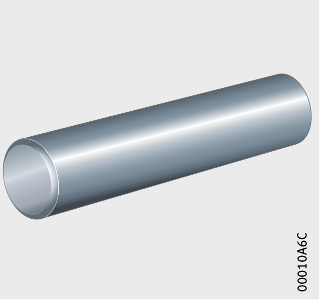
Designation[1) 2)]	Mass	Dimensions			Basic load ratings		Fatigue limit load
	m	F_w	E_w	B_c	dyn. C_r	stat. C_{0r}	C_{ur}
	≈g				N	N	N
KZK8X12X8	2,2	**8**	12	8	3 900	3 400	415
KZK10X14X10	4,6	**10**	14	10	4 150	3 900	485
KZK12X16X10	3,5	**12**	16	10	6 400	7 200	880
KZK12X17X10	5	**12**	17	10	7 400	7 400	980
KZK13X17X10	4	**13**	17	10	6 500	7 300	870
KZK14X18X10	4	**14**	18	10	7 100	8 500	1 060
KZK14,4X20,4X10	6,5	**14,4**	20,4	10	8 100	7 800	1 030
KZK15X21X11,15	9	**15**	21	11,15	10 100	10 600	1 290
KZK16X21X10	6	**16**	21	10	8 200	9 200	1 210
KZK16X22X10	7,7	**16**	22	10	9 200	9 500	1 140
KZK16X22X12	9	**16**	22	12	11 000	11 900	1 670
KZK18X24X12	10	**18**	24	12	11 600	13 100	1 840
KZK18X24X13	12,5	**18**	24	13	12 100	13 800	1 740
KZK19X25X15	15	**19**	25	15	13 000	15 400	1 870
KZK20X28X16	26	**20**	28	16	17 900	19 700	2 350
KZK22X28X13	15	**22**	28	13	13 900	17 500	2 490
KZK22X28X16	18	**22**	28	16	13 600	20 200	2 500
KZK22X29X16	20	**22**	29	16	17 800	21 800	2 850
KZK23,1X28,1X14	11	**23,1**	28,1	14	13 100	18 600	2 250
KZK25X32X16	24,4	**25**	32	16	18 200	23 100	3 050
KZK25,1X30,1X14	13	**25,1**	30,1	14	14 000	20 800	2 500
KZK26X31X16	16	**26**	31	16	17 200	27 500	3 400
KZK26X33X14	23	**26**	33	14	19 100	24 900	3 200
KZK28X33X14	14	**28**	33	14	14 800	23 100	2 800
KZK28X35X17	33	**28**	35	17	21 700	30 000	3 700
KZK28X35X18	27	**28**	35	18	23 400	33 000	4 200
KZK28X36X14	28	**28**	36	14	20 300	25 000	3 950
KZK28X36X16	30	**28**	36	16	23 300	30 000	3 650
KZK30X38X16	32	**30**	38	16	22 800	30 000	3 500
KZK30X38X18	35	**30**	38	18	25 500	35 000	4 250

1) The needle roller and cage assemblies are available by agreement only.
Production is dependent on economically viable quantities.

2) The designation indicates the dimensions.
For a precise ordering designation, please contact the Schaeffler engineering service.

Needle roller

NRB



Needle rollers

Features

Needle rollers are the basic elements of needle roller bearings. They are made from through hardened rolling bearing steel 100Cr6 to DIN 17230, have a hardness of at least 670 HV and conform to DIN 5402-3/ISO 3096-B with flat end faces.

The ends of the needle rollers are profiled. Due to this profiling, the outside surfaces have a curved transition to the end faces. This reduces the edge stresses at the ends of the rolling elements.

Needle rollers are available in the diameter range from 1 mm to 6 mm, in lengths from 2 mm to 43,8 mm and in grade G2.

! The further information on needle rollers in Catalogue HR 1, Rolling Bearings, chapter Rolling Elements must be observed.

Sorts

Needle rollers are divided into sorts with very small diameter and length tolerances. Each sort is packed separately and the lower deviation is marked on the packaging.

One pack contains needle rollers of one sort only. In a delivery comprising several packs, the sort may differ from one pack to another.

! Needle rollers of only one sort should be used in one bearing arrangement.

Special designs are available by agreement and for economically viable quantities only.

Accuracy

The dimensional and geometrical accuracy conforms to DIN 5402-3/ISO 3096.

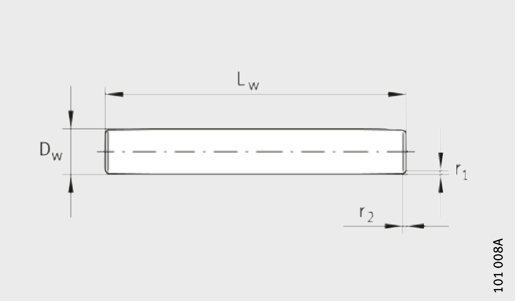
Dimensional and geometrical accuracy, sorts, roughness

Grade	Deviations and tolerances for diameter D_w [1]							Length tolerance
	Deviation µm	Tolerance of one sort µm max.	Sorts[2] µm			Roundness µm max.	Roughness R_a µm max.	
G2	0 – 10	2	**0 –2**	**–1 –3**	**–2 –4**	1	0,1	h13
			–3 –5	**–4 –6**	**–5 –7**			
			–6 –8	–7 –9	–8 –10			

[1] The roundness is produced in accordance with DIN 1101. The tolerance values apply at the centre of the needle rollers.

[2] Preferred sorts are printed bold.

Needle rollers



NRB

Dimension table · Dimensions in mm

Designation	Mass[1)]	Dimensions				
	m	D_w	L_w	r_1 r_2[2)]	r_1	r_2[2)]
	≈kg			min.	max.	max.
NRB1X7,8-G2	0,048	**1**	7,8	0,1	0,4	0,6
NRB1,5X5,8-G2	0,081	**1,5**	5,8	0,1	0,4	0,6
NRB1,5X6,8-G2	0,094	**1,5**	6,8	0,1	0,4	0,6
NRB1,5X7,8-G2	0,108	**1,5**	7,8	0,1	0,4	0,6
NRB1,5X9,8-G2	0,136	**1,5**	9,8	0,1	0,4	0,6
NRB1,5X11,8-G2	0,164	**1,5**	11,8	0,1	0,4	0,6
NRB1,5X13,8-G2	0,191	**1,5**	13,8	0,1	0,4	0,6
NRB2X6,3-G2	0,16	**2**	6,3	0,2	0,6	0,8
NRB2X7,8-G2	0,19	**2**	7,8	0,2	0,6	0,8
NRB2X9,8-G2	0,24	**2**	9,8	0,2	0,6	0,8
NRB2X11,8-G2	0,29	**2**	11,8	0,2	0,6	0,8
NRB2X13,8-G2	0,34	**2**	13,8	0,2	0,6	0,8
NRB2X15,8-G2	0,39	**2**	15,8	0,2	0,6	0,8
NRB2X17,8-G2	0,44	**2**	17,8	0,2	0,6	0,8
NRB2X19,8-G2	0,49	**2**	19,8	0,2	0,6	0,8
NRB2X21,8-G2	0,54	**2**	21,8	0,2	0,6	0,8
NRB2,5X7,8-G2	0,3	**2,5**	7,8	0,2	0,6	0,8
NRB2,5X9,8-G2	0,38	**2,5**	9,8	0,2	0,6	0,8
NRB2,5X11,8-G2	0,45	**2,5**	11,8	0,2	0,6	0,8
NRB2,5X13,8-G2	0,53	**2,5**	13,8	0,2	0,6	0,8
NRB2,5X15,8-G2	0,61	**2,5**	15,8	0,2	0,6	0,8
NRB2,5X17,8-G2	0,69	**2,5**	17,8	0,2	0,6	0,8
NRB2,5X19,8-G2	0,76	**2,5**	19,8	0,2	0,6	0,8
NRB2,5X21,8-G2	0,84	**2,5**	21,8	0,2	0,6	0,8
NRB2,5X23,8-G2	0,92	**2,5**	23,8	0,2	0,6	0,8
NRB3X9,8-G2	0,54	**3**	9,8	0,2	0,6	0,8
NRB3X11,8-G2	0,65	**3**	11,8	0,2	0,6	0,8
NRB3X13,8-G2	0,77	**3**	13,8	0,2	0,6	0,8
NRB3X15,8-G2	0,88	**3**	15,8	0,2	0,6	0,8
NRB3X17,8-G2	0,99	**3**	17,8	0,2	0,6	0,8
NRB3X19,8-G2	1,1	**3**	19,8	0,2	0,6	0,8
NRB3X21,8-G2	1,21	**3**	21,8	0,2	0,6	0,8
NRB3X23,8-G2	1,32	**3**	23,8	0,2	0,6	0,8

1) In each case for 1000 pieces.

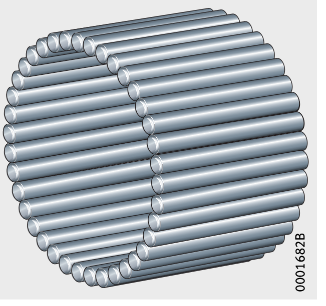
2) Mean values;
the transition to the profiled outside surface can only be estimated.

Dimension table · Dimensions in mm

Designation	Mass[1)]	Dimensions				
	m	D_w	L_w	r_1 r_2[2)]	r_1	r_2[2)]
	≈kg			min.	max.	max.
NRB3,5X11,8-G2	0,89	**3,5**	11,8	0,3	0,8	1
NRB3,5X13,8-G2	1,04	**3,5**	13,8	0,3	0,8	1
NRB3,5X15,8-G2	1,19	**3,5**	15,8	0,3	0,8	1
NRB3,5X17,8-G2	1,34	**3,5**	17,8	0,3	0,8	1
NRB3,5X19,8-G2	1,5	**3,5**	19,8	0,3	0,8	1
NRB3,5X21,8-G2	1,65	**3,5**	21,8	0,3	0,8	1
NRB3,5X29,8-G2	2,25	**3,5**	29,8	0,3	0,8	1
NRB3,5X34,8-G2	2,63	**3,5**	34,8	0,3	0,8	1
NRB4X11,8-G2	1,16	**4**	11,8	0,3	0,8	1
NRB4X13,8-G2	1,36	**4**	13,8	0,3	0,8	1
NRB4X15,8-G2	1,56	**4**	15,8	0,3	0,8	1
NRB4X17,8-G2	1,76	**4**	17,8	0,3	0,8	1
NRB4X19,8-G2	1,95	**4**	19,8	0,3	0,8	1
NRB4X21,8-G2	2,15	**4**	21,8	0,3	0,8	1
NRB4X23,8-G2	2,35	**4**	23,8	0,3	0,8	1
NRB4X25,8-G2	2,55	**4**	25,8	0,3	0,8	1
NRB4X27,8-G2	2,74	**4**	27,8	0,3	0,8	1
NRB4X29,8-G2	2,94	**4**	29,8	0,3	0,8	1
NRB4X34,8-G2	3,43	**4**	34,8	0,3	0,8	1
NRB4X39,8-G2	3,93	**4**	39,8	0,3	0,8	1
NRB5X15,8-G2	2,44	**5**	15,8	0,3	0,8	1
NRB5X19,8-G2	3,05	**5**	19,8	0,3	0,8	1
NRB5X21,8-G2	3,36	**5**	21,8	0,3	0,8	1
NRB5X23,8-G2	3,67	**5**	23,8	0,3	0,8	1
NRB5X25,8-G2	3,98	**5**	25,8	0,3	0,8	1
NRB5X27,8-G2	4,28	**5**	27,8	0,3	0,8	1
NRB5X29,8-G2	4,59	**5**	29,8	0,3	0,8	1
NRB5X34,8-G2	5,36	**5**	34,8	0,3	0,8	1
NRB5X39,8-G2	6,13	**5**	39,8	0,3	0,8	1
NRB6X17,8-G2	3,95	**6**	17,8	0,3	0,8	1

Full complement needle roller arrangements

Full complement needle roller arrangement



Full complement needle roller arrangements

Features

Full complement needle roller arrangements completely fill the available space with needle rollers. This gives particularly compact bearing arrangements that have very high load carrying capacity and high rigidity. They allow bearing arrangements with high radial runout accuracy and a defined radial internal clearance, dependent on the geometrical accuracy of the raceways.

Such bearing arrangements are particularly suitable for swivel motion and high radial loads.

For permissible speeds, please contact the Schaeffler engineering service.

Design of full complement needle roller arrangements

The following must be taken into consideration in the design of full complement needle roller arrangements:

- the raceway dimensions for the shaft and housing bore
- the rolling element diameter
- the number of rolling elements.

Raceway design

Requirements for the bearing arrangement	Tolerance zone		Surface quality		
	Bore	Shaft	Roughness max.	Roundness max.	Parallelism max.
Standard	G7	h6	Ra 0,2 (Ra 1)	IT3	IT3
High	G6	g5	Ra 0,2 (Ra 1)	IT3	IT3

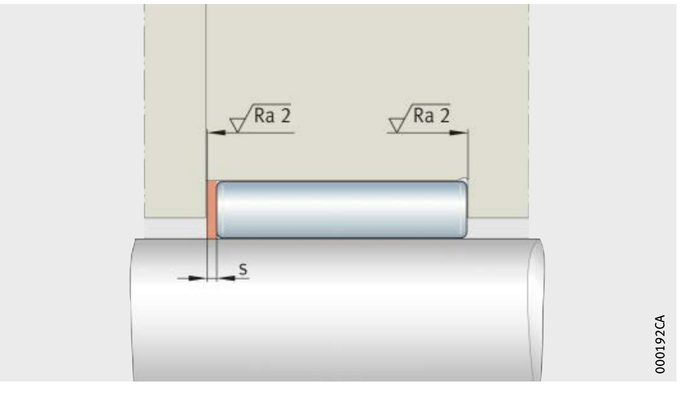
!

For each bearing arrangement, needle rollers of one sort only should be used.

The shaft and housing bore must be designed for use as rolling bearing raceways, see table.

The axial running surfaces for the needle rollers must be precision machined (Ra 2 recommended) and wear-resistant, *Figure 1*.

In order to restrict axial movement, a clearance “s” of 0,2 mm to 0,4 mm must be observed, *Figure 1*.



s = axial clearance

Figure 1
Axial running surfaces and axial clearance

Full complement needle roller arrangements

Determination of basic load ratings

The basic load ratings of full complement needle roller arrangements are determined from the following equations:

$$L_{we} = L_w - 2 \cdot r_{2\,min}$$

$$C_r = k_c \cdot L_{we}^{7/9}$$

$$C_{0r} = \frac{44}{1 + D_w / F} \cdot D_w \cdot L_{we} \cdot Z$$

L_{we} mm
Effective rolling element length

L_w mm
Rolling element length, nominal dimension

$r_{2\,min}$ mm
Minimum axial chamfer distance of the rolling element, see page 68

C_r, C_{0r} N
Basic radial dynamic or static load rating

k_c –
Basic load rating factor, see table

D_w mm
Rolling element diameter

F mm
Raceway diameter of shaft

Z –
Number of rolling elements.

Example

The full complement needle roller arrangement in this case comprises 24 needle rollers NRB3×11,8G2.

The raceway dimensions and basic load ratings C_r, C_{0r} are to be determined.

Nominal dimensions and basic load rating factors

Dimensions and factors[1]		
Raceway dimensions	F	20,022
	E	26,022
Basic load rating factor	k_c	2 984

[1] Values from table, page 76.

Effective rolling element length

$$L_{we} = 11{,}8 - 2 \cdot 0{,}2 = 11{,}4$$

Basic dynamic load rating C_r

$$C_r = 2984 \cdot 11{,}4^{7/9} = 19\,800\,\text{N}$$

Basic static load rating C_{0r}

$$C_{0r} = \frac{44}{1 + 3 / 22{,}022} \cdot 3 \cdot 11{,}4 \cdot 24 = 31\,400\,\text{N}$$

Determination of circumferential clearance

The circumferential clearance TES is valid for rolling element diameters $D_W \leqq 6$ mm.

The following minimum values must be observed for the TES:

- for $D_W \leqq 3,5$ mm = 0,1 mm
- for $D_W > 3,5$ mm and at least 0,15 mm.

$$TES = 5 \cdot 10^{-3} \cdot Z$$

TES mm
Circumferential clearance, *Figure 2*

Z –
Number of rolling elements, *Figure 2*.

Determination of raceway dimensions

The only valid dimensions are given in the table, page 76:

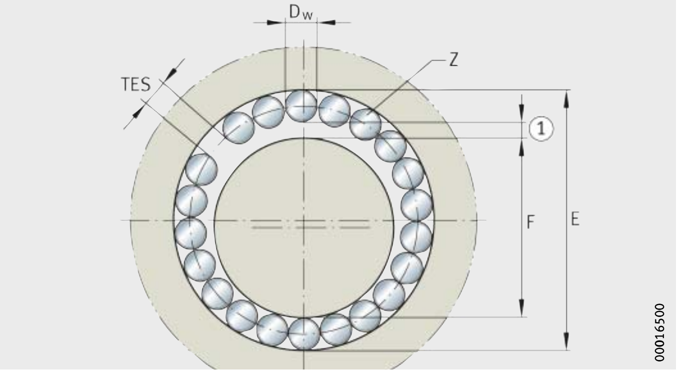
$$F = \frac{D_w + TES/Z}{\sin(180/Z)} - D_w$$

$$E = F + 2 \cdot D_w$$

F mm
Raceway diameter of shaft, *Figure 2*

D_w mm
Rolling element diameter, *Figure 2*

E mm
Raceway diameter of housing bore, *Figure 2*.



① Radial operating clearance

TES = circumferential clearance
D_w = rolling element diameter
Z = number of rolling elements
F = raceway diameter of shaft
E = raceway diameter of housing bore

Figure 2
Nominal dimensions and tolerances

Full complement needle roller arrangements

Determination of radial internal clearance

$$s_{min} = E_{min} - F_{max} - 2 \cdot D_{W\,max}$$

$$s_{max} = E_{max} - F_{min} - 2 \cdot D_{W\,min}$$

s_{min}, s_{max} μm
Minimum and maximum radial internal clearance

E_{min}, E_{max} mm
Minimum and maximum raceway diameter of housing bore

F_{min}, F_{max} mm
Minimum and maximum raceway diameter of shaft

$D_{W\,min}$, $D_{W\,max}$ mm
Minimum and maximum possible diameter of needle roller sort used.

Example

Needle roller sort 0–2

$$s_{min} = 26{,}029\,mm - 20{,}022\,mm - 2 \cdot 3{,}000\,mm = 7\,\mu m$$

Needle roller sort –5–7

$$s_{max} = 26{,}050\,mm - 20{,}009\,mm - 2 \cdot 2{,}993\,mm = 55\,\mu m$$

Full complement needle roller arrangements

Nominal dimensions, basic load rating factors for needle rollers of grade G2, sorts in deviation range 0 to –7 μm, nominal dimensions in mm

	D_w = 1,0 mm		
Z	F	E	k_c
10	2,268	4,268	454
11	2,582	4,582	500
12	2,896	4,896	542
13	3,211	5,211	582
14	3,526	5,526	619
15	3,842	5,842	655
16	4,158	6,158	689
17	4,474	6,474	722
18	4,791	6,791	753
19	5,108	7,108	783
20	5,424	7,424	811
21	5,743	7,743	839
22	6,062	8,062	866
23	6,381	8,381	891
24	6,700	8,700	917
25	7,019	9,019	941
26	7,338	9,338	965
27	7,657	9,657	988
28	7,976	9,976	1 010
29	8,295	10,295	1 032
30	8,615	10,615	1 054
31	8,934	10,934	1 075
32	9,253	11,253	1 095
33	9,573	11,573	1 116
34	9,892	11,892	1 135
35	10,212	12,212	1 155
36	10,531	12,531	1 174
37	10,851	12,851	1 193
38	11,170	13,170	1 211
39	11,490	13,490	1 229
40	11,809	13,809	1 247
41	12,129	14,129	1 265
42	12,448	14,448	1 282
43	12,768	14,768	1 300
44	13,088	15,088	1 317
45	13,407	15,407	1 333
46	13,727	15,727	1 350
47	14,047	16,047	1 366
48	14,366	16,366	1 382
49	14,686	16,686	1 398
50	15,006	17,006	1 414

$D_w = 1,5$ mm			$D_w = 2,0$ mm			$D_w = 2,5$ mm		
F	E	k_c	F	E	k_c	F	E	k_c
3,386	6,386	702	4,504	8,504	956	5,623	10,623	1 214
3,856	6,856	772	5,131	9,131	1 051	6,406	11,406	1 335
4,328	7,328	837	5,760	9,760	1 140	7,191	12,191	1 448
4,800	7,800	899	6,389	10,389	1 224	7,979	12,979	1 555
5,273	8,273	957	7,020	11,020	1 304	8,767	13,767	1 657
5,747	8,747	1 012	7,652	11,652	1 379	9,556	14,556	1 752
6,221	9,221	1 065	8,284	12,284	1 451	10,347	15,347	1 844
6,695	9,695	1 115	8,916	12,916	1 519	11,137	16,137	1 931
7,170	10,170	1 163	9,550	13,550	1 585	11,929	16,929	2 014
7,645	10,645	1 210	10,183	14,183	1 648	12,721	17,721	2 094
8,121	11,121	1 254	10,817	14,817	1 708	13,513	18,513	2 171
8,598	11,598	1 297	11,453	15,453	1 766	14,307	19,307	2 245
9,075	12,075	1 338	12,088	16,088	1 823	15,102	20,102	2 317
9,553	12,553	1 378	12,725	16,725	1 877	15,897	20,897	2 386
10,030	13,030	1 417	13,361	17,361	1 930	16,692	21,692	2 453
10,508	13,508	1 455	13,997	17,997	1 982	17,487	22,487	2 518
10,986	13,986	1 491	14,634	18,634	2 031	18,282	23,282	2 582
11,464	14,464	1 527	15,271	19,271	2 080	19,078	24,078	2 644
11,942	14,942	1 562	15,907	19,907	2 128	19,873	24,873	2 704
12,420	15,420	1 596	16,544	20,544	2 174	20,669	25,669	2 763
12,898	15,898	1 629	17,181	21,181	2 219	21,465	26,465	2 820
13,376	16,376	1 662	17,818	21,818	2 264	22,261	27,261	2 877
13,854	16,854	1 694	18,456	22,456	2 307	23,057	28,057	2 932
14,333	17,333	1 725	19,093	23,093	2 350	23,853	28,853	2 986
14,811	17,811	1 755	19,730	23,730	2 391	24,649	29,649	3 039
15,290	18,290	1 786	20,367	24,367	2 432	25,445	30,445	3 091
15,768	18,768	1 815	21,005	25,005	2 473	26,242	31,242	3 143
16,246	19,246	1 844	21,642	25,642	2 512	27,038	32,038	3 193
16,725	19,725	1 873	22,280	26,280	2 551	27,834	32,834	3 242
17,203	20,203	1 901	22,917	26,917	2 590	28,631	33,631	3 291
17,682	20,682	1 929	23,555	27,555	2 627	29,427	34,427	3 339
18,161	21,161	1 956	24,192	28,192	2 665	30,224	35,224	3 387
18,639	21,639	1 983	24,830	28,830	2 701	31,021	36,021	3 433
19,118	22,118	2 009	25,468	29,468	2 737	31,817	36,817	3 479
19,596	22,596	2 036	26,105	30,105	2 773	32,614	37,614	3 525
20,075	23,075	2 062	26,743	30,743	2 808	33,411	38,411	3 569
20,554	23,554	2 087	27,381	31,381	2 843	34,207	39,207	3 614
21,032	24,032	2 112	28,018	32,018	2 878	35,004	40,004	3 657
21,511	24,511	2 137	28,656	32,656	2 912	35,801	40,801	3 701
21,990	24,990	2 162	29,294	33,294	2 945	36,598	41,598	3 743
22,469	25,469	2 186	29,932	33,932	2 978	37,395	42,395	3 785

Full complement needle roller arrangements

Nominal dimensions, basic load rating factors for needle rollers of grade G2, sorts in deviation range 0 to –7 μm, nominal dimensions in mm
continued

Z	D_w = 3,0 mm		
	F	E	k_c
10	6,741	12,741	1 476
11	7,681	13,681	1 623
12	8,623	14,623	1 762
13	9,568	15,568	1 892
14	10,514	16,514	2 015
15	11,461	17,461	2 131
16	12,410	18,410	2 242
17	13,359	19,359	2 348
18	14,308	20,308	2 450
19	15,259	21,259	2 547
20	16,209	22,209	2 640
21	17,162	23,162	2 731
22	18,115	24,115	2 818
23	19,069	25,069	2 902
24	20,022	26,022	2 984
25	20,976	26,976	3 063
26	21,930	27,930	3 140
27	22,884	28,884	3 216
28	23,839	29,839	3 289
29	24,793	30,793	3 361
30	25,748	31,748	3 431
31	26,703	32,703	3 499
32	27,658	33,658	3 566
33	28,613	34,613	3 632
34	29,568	35,568	3 697
35	30,523	36,523	3 760
36	31,479	37,479	3 823
37	32,434	38,434	3 884
38	33,389	39,389	3 944
39	34,345	40,345	4 003
40	35,300	41,300	4 062
41	36,256	42,256	4 119
42	37,211	43,211	4 176
43	38,167	44,167	4 232
44	39,123	45,123	4 287
45	40,078	46,078	4 342
46	41,034	47,034	4 396
47	41,990	47,990	4 449
48	42,946	48,946	4 501
49	43,902	49,902	4 553
50	44,858	50,858	4 605

D_W = 3,5 mm			D_W = 4,0 mm			D_W = 5,0 mm			D_W = 6,0 mm		
F	E	k_c	F	E	k_c	F	E	k_c	F	E	k_c
7,859	14,859	1 742	8,993	16,993	2 011	11,229	21,229	2 555	13,465	25,465	3 107
8,955	15,955	1 916	10,246	18,246	2 211	12,796	22,796	2 810	15,345	27,345	3 417
10,055	17,055	2 079	11,503	19,503	2 400	14,367	24,367	3 049	17,231	29,231	3 709
11,157	18,157	2 232	12,763	20,763	2 577	15,941	25,941	3 274	19,120	31,120	3 983
12,261	19,261	2 378	14,024	22,024	2 744	17,518	27,518	3 487	21,012	33,012	4 242
13,366	20,366	2 515	15,287	23,287	2 903	19,097	29,097	3 689	22,907	34,907	4 487
14,472	21,472	2 646	16,551	24,551	3 054	20,677	30,677	3 881	24,803	36,803	4 721
15,580	22,580	2 771	17,817	25,817	3 199	22,259	32,259	4 065	26,701	38,701	4 944
16,688	23,688	2 891	19,083	27,083	3 337	23,842	33,842	4 240	28,601	40,601	5 158
17,796	24,796	3 006	20,350	28,350	3 469	25,426	35,426	4 409	30,501	42,501	5 363
18,906	25,906	3 116	21,618	29,618	3 596	27,010	37,010	4 571	32,403	44,403	5 560
20,017	27,017	3 222	22,886	30,886	3 719	28,595	38,595	4 727	34,305	46,305	5 749
21,128	28,128	3 325	24,155	32,155	3 838	30,181	40,181	4 877	36,208	48,208	5 933
22,241	29,241	3 425	25,424	33,424	3 953	31,768	41,768	5 023	38,112	50,112	6 111
23,353	30,353	3 521	26,693	34,693	4 064	33,354	43,354	5 165	40,016	52,016	6 283
24,465	31,465	3 615	27,963	35,963	4 172	34,942	44,942	5 302	41,920	53,920	6 450
25,578	32,578	3 706	29,233	37,233	4 278	36,529	46,529	5 436	43,825	55,825	6 613
26,691	33,691	3 795	30,503	38,503	4 380	38,117	48,117	5 567	45,731	57,731	6 771
27,805	34,805	3 881	31,773	39,773	4 480	39,705	49,705	5 694	47,636	59,636	6 926
28,918	35,918	3 966	33,044	41,044	4 578	41,293	51,293	5 818	49,542	61,542	7 077
30,032	37,032	4 049	34,315	42,315	4 673	42,882	52,882	5 939	51,448	63,448	7 224
31,145	38,145	4 130	35,587	43,587	4 766	44,472	54,472	6 058	53,357	65,357	7 369
32,259	39,259	4 209	36,860	44,860	4 858	46,062	56,062	6 174	55,265	67,265	7 510
33,373	40,373	4 286	38,133	46,133	4 948	47,653	57,653	6 288	57,173	69,173	7 649
34,487	41,487	4 363	39,406	47,406	5 036	49,244	59,244	6 400	59,082	71,082	7 785
35,601	42,601	4 437	40,679	48,679	5 122	50,835	60,835	6 509	60,991	72,991	7 918
36,715	43,715	4 511	41,952	49,952	5 207	52,426	62,426	6 617	62,900	74,900	8 049
37,830	44,830	4 583	43,225	51,225	5 290	54,017	64,017	6 723	64,809	76,809	8 178
38,944	45,944	4 654	44,499	52,499	5 372	55,608	65,608	6 828	66,718	78,718	8 305
40,058	47,058	4 724	45,772	53,772	5 453	57,200	67,200	6 930	68,627	80,627	8 430
41,173	48,173	4 793	47,046	55,046	5 533	58,791	68,791	7 031	70,537	82,537	8 553
42,288	49,288	4 861	48,319	56,319	5 611	60,383	70,383	7 131	72,446	84,446	8 674
43,402	50,402	4 928	49,593	57,593	5 688	61,974	71,974	7 229	74,356	86,356	8 794
44,517	51,517	4 994	50,867	58,867	5 765	63,566	73,566	7 326	76,266	88,266	8 912
45,631	52,631	5 059	52,140	60,140	5 840	65,158	75,158	7 422	78,175	90,175	9 028
46,746	53,746	5 124	53,414	61,414	5 914	66,750	76,750	7 516	80,085	92,085	9 143
47,861	54,861	5 187	54,688	62,688	5 988	68,341	78,341	7 609	81,995	93,995	9 256
48,976	55,976	5 250	55,962	63,962	6 060	69,933	79,933	7 701	83,905	95,905	9 368
50,091	57,091	5 312	57,236	65,236	6 132	71,525	81,525	7 792	85,815	97,815	9 479
51,206	58,206	5 373	58,510	66,510	6 202	73,117	83,117	7 882	87,725	99,725	9 588
52,321	59,321	5 434	59,784	67,784	6 272	74,709	84,709	7 971	89,635	101,635	9 696

Product overview Full complement needle roller sets

Full complement needle roller set

Single row or multiple row with transport sleeve inside and outside

VRS

Full complement needle roller sets

Features

In the case of full complement needle roller arrangements, Schaeffler supplies the needle rollers and the customer assembles his bearing arrangement himself according to the information in section Full complement needle roller arrangements, see page 71.

In the case of full complement needle roller sets (single row or multiple row), Schaeffler supplies the finished bearing set VRS for mounting. The rolling elements are protected against damage and loss by means of plastic transport sleeves.

For full complement needle roller sets, the following information must be provided by the customer:

- the design envelope
- the basic load ratings required
- the speeds present
- the type of bearing lubrication.

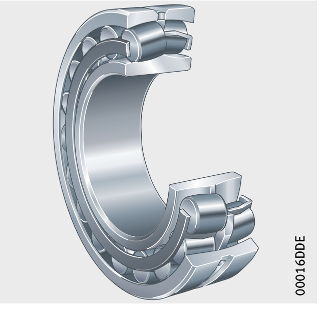
The data relevant to the bearing set and its mounting are described in the customer delivery drawing.

For permissible speeds, please contact the Schaeffler engineering service.

Cylindrical bore

Design E1

223..-E1



Spherical roller bearings

Features

Spherical roller bearings are double row, self-retaining units comprising solid outer rings with a concave raceway, solid inner rings with a cylindrical bore and barrel rollers with cages. The inner rings have cylindrical bores.

The symmetrical barrel rollers orient themselves freely on the concave outer ring raceway. This allows compensation of misalignments and tooth deviations.

Spherical roller bearings can be used in planetary gears where particularly economical solutions are required and low speeds are present. In this case, they are used without an outer ring.

Spherical roller bearings can be lubricated with oil or grease.

The further information on spherical roller bearings in Catalogue HR 1, Rolling Bearings must be observed.

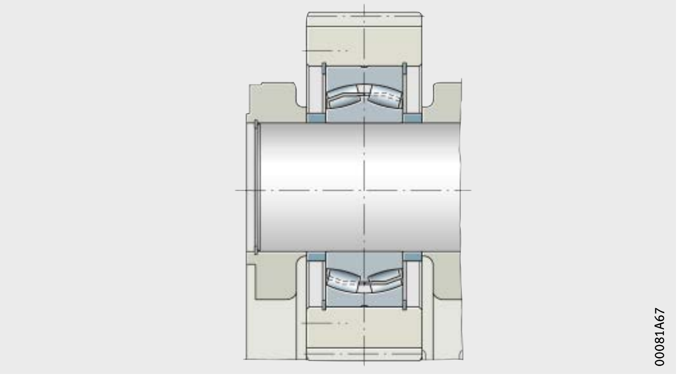


Figure 1
Gear with spherical roller bearing

Radial and axial load carrying capacity

Spherical roller bearings can support axial forces in both directions and high radial forces.

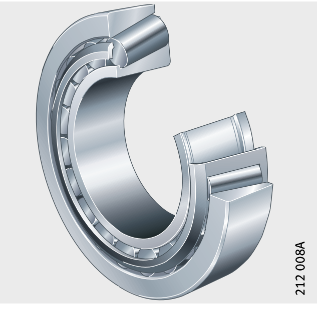
They are designed for very high load carrying capacity and, since they have the maximum possible number of large and particularly long barrel rollers, are also suitable for the heaviest loads.

Minimum radial load

In order to achieve slippage-free operation, a minimum radial load $F_{r\,min}$ of the order of $P/C_r > 0{,}02$ is necessary.

Single row

320



Features

Tapered roller bearings comprise solid inner and outer rings with tapered raceways and tapered rollers with cages made from pressed sheet steel.

The bearings are not self-retaining. As a result, the inner ring with the rollers and the cage can be mounted separately from the outer ring.

The bearings are supplied in an open design. They can be lubricated with oil or grease.

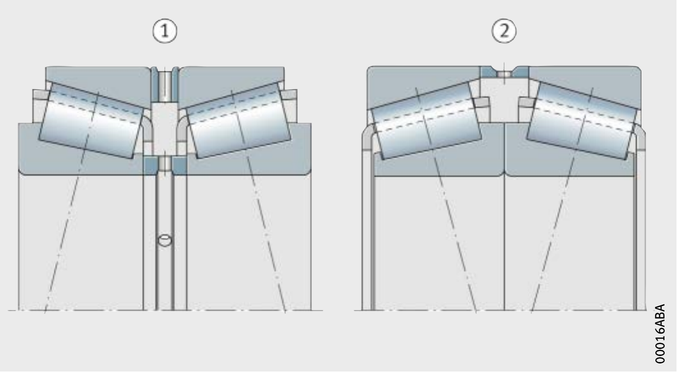
The further information on tapered roller bearings in Catalogue HR 1, Rolling Bearings must be observed.

Radial and axial load carrying capacity

Tapered roller bearings can support axial forces in one direction and high radial forces.

They must normally be axially adjusted against a second bearing in a mirror image arrangement. This bearing combination is mounted in an O or X arrangement, *Figure 1*.

N11BA
N11CA



1 O arrangement
2 X arrangement

Figure 1
Matched tapered roller bearings

Matched bearings

These tapered roller bearings are mounted in pairs in an O or X arrangement. They can thus support high axial forces from both directions as well as moment loads.

Tapered roller bearings in an O or X arrangement have the advantage that the bearing arrangement can be set clearance-free if necessary.

This solution is applied, for example, in wind turbine gearboxes.

Minimum radial load

In order to ensure operation without slippage, the bearings must be subjected to a minimum load $F_{r\,min}$ in a radial direction.
In continuous operation, a minimum radial load of the order of $P/C_r > 0{,}02$ is necessary for roller bearings with cage.

Special solutions

Special solutions

Special solutions

Standard bearings for planetary gearboxes have a wide scope of performance characteristics and are adequate for most applications.

If the application places greater requirements on the bearings, Schaeffler can develop special solutions in partnership with the customer. The Schaeffler engineering service should be involved in the design process as early as possible.

X-life

Many bearings for planetary gearboxes are available in X-life quality.

Surface quality increases load carrying capacity

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

Thanks to such improvements, the basic dynamic load ratings are significantly higher than those of the previous designs.
This results in an increased basic rating life. If the previous rating life is still taken as a basic requirement, the bearing arrangement can then be subjected to a higher load.

!

In the case of bearings without an outer ring, particular requirements must be observed for the design of the raceway in the planetary gear, see section Raceways for bearings without inner and/or outer ring, page 19.

Cage design

The cage has the following functions:

- to separate the rolling elements from each other in order to minimise friction and heat generation
- to maintain the rolling elements at the same distance from each other in order to ensure uniform load distribution
- to guide the rolling elements in the load-free zone of the bearing.

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

Aluminium cage

If aluminium is used as a material, the mass of these externally guided cages can be reduced, *Figure 1*. They are suitable for applications with moderate to high accelerations.

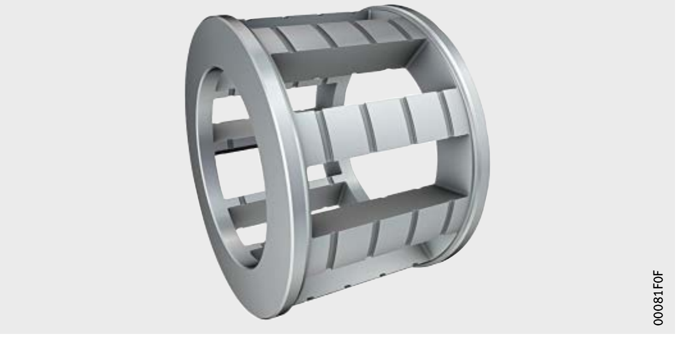


Figure 1
Aluminium cage

Steel cage

Steel cages are suitable for high temperatures and are unaffected by synthetic oils and greases, *Figure 2*. The small cage cross-section gives good oil flow within the bearing.

Figure 2
Steel cage

Cages for high accelerations

High accelerations, such as those occurring in input stages or in centrifuges, require special bearing designs.

Special cages

The suitability of bearings is influenced to a significant degree by the use of a cage as well as its specific version and design.

Under extremely high accelerations, needle roller and cage assemblies, bearings with an externally guided cage (KZK) or a special brass cage with optimised stress characteristics are required, *Figure 3*. In these cases, please consult the Schaeffler engineering service.

Solid brass cage (special cage)

Figure 3
Optimised cage
for high accelerations

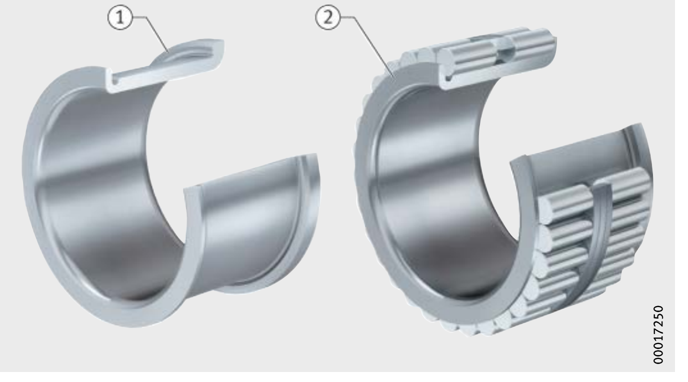
Bearing arrangements with optimised mass

Gearboxes are increasingly compact, with increasing power levels and reduced mass, placing particular requirements on the rolling bearings.

Bearing rings of very small cross-section

Schaeffler has been a leader in forming technology for many years. This technology can be used for the economical production of bearing rings of extremely small cross-section with high load carrying capacity and rigidity, *Figure 4*.

Production of these bearings is conditional on sufficiently large quantities.



① Bearing ring produced by forming method
② Full complement roller bearing with bearing ring produced by forming

Figure 4
Inner rings produced by forming

Floating planetary gear bearing arrangements

In the case of planetary gear pins supported on one side, the transition from the pin to the planet carrier is subjected to bending loads, which are high in some cases.

Optimised edge radii

The fracture sensitivity at this point can be significantly reduced by appropriate radii. For this reason, bearings for these applications have an edge transition with large dimensions on one side of the inside diameter, *Figure 5*.

Schaeffler has a large number of such special bearings.

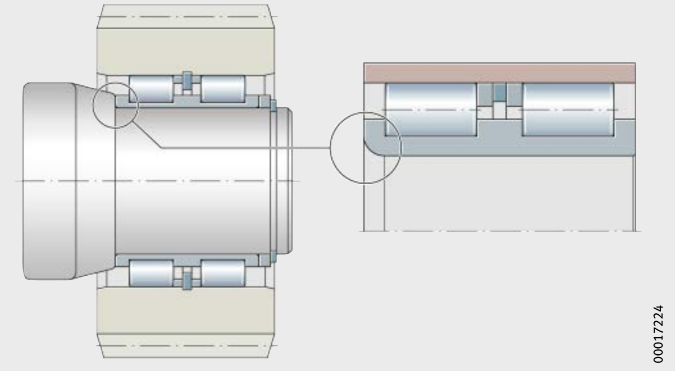


Figure 5
Reduced fracture sensitivity due to optimised edge radii

Axial location of bearings

In addition to the design examples on pages 24 to 26, a special solution for the axial location of bearings has also proven successful in particular applications.

Location by means of L-section rings

Axial location in the planet and the guidance of rolling elements can be achieved, instead of two retaining rings and two axial washers, *Figure 1*, page 24, by using two L-section rings (snap rings BRL). This reduces the number of components and gives easier mounting.

The use of L-section rings can be beneficial for larger quantities, with production carried out by agreement.

Coated bearings

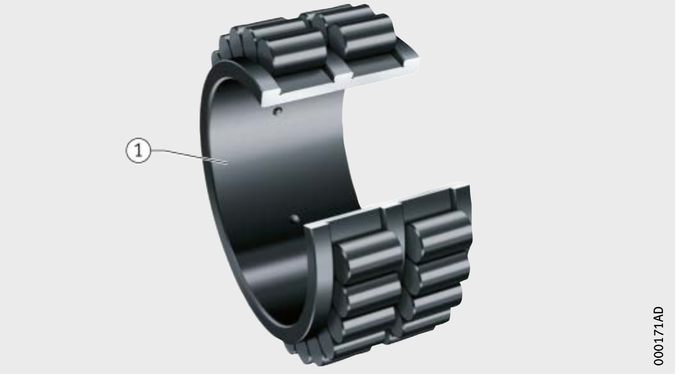
Standard bearings have a high performance capacity, a long operating life and are highly suitable for most bearing arrangement tasks. In order to increase the bearing operating life, coatings of various types may be used in unusual operating conditions.

Black oxide coating

Black oxide coating is a highly effective and economical coating method. This surface coating improves the running-in behaviour and is used where there is a risk of smearing, *Figure 6*.

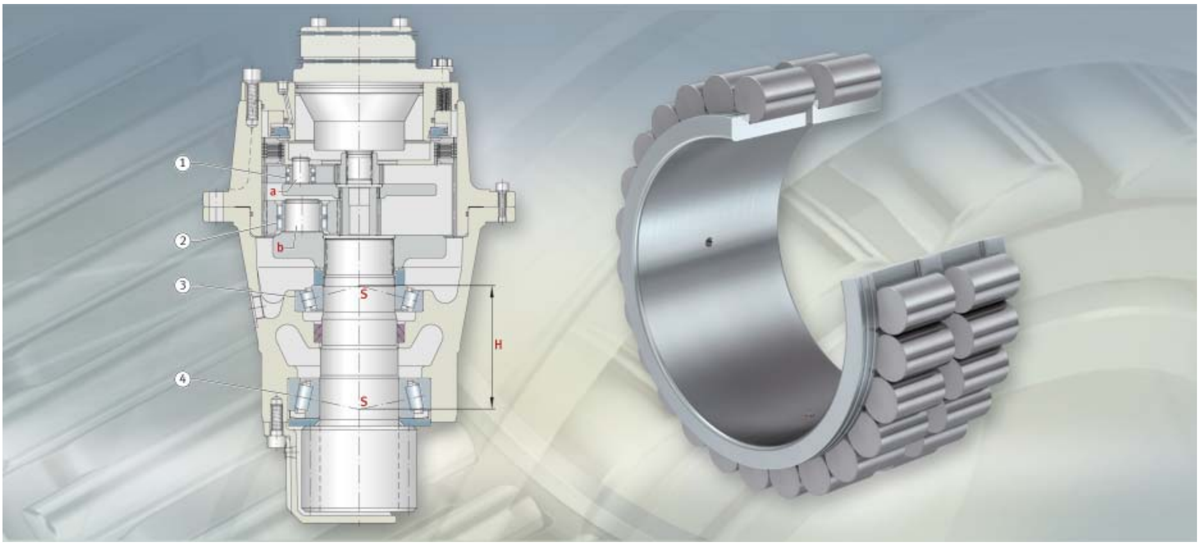
If low speeds under high loads are present in planetary sets, black oxide coating gives a significantly higher wear resistance and thus a longer operating life.

Further information can be found in publication TPI 186, Higher Performance Capacity through the Use of Coatings.



① Coated cylindrical roller bearing RSL without outer ring

Figure 6
Bearing with black oxide coating to prevent smearing



Applications in planetary gearboxes

Applications in planetary gearboxes

Pitch and yaw gearbox for wind turbines

The rotatable nacelle of a wind turbine is located at a height of up to 120 m. It contains almost the complete electronic system as well as the drive train and the generator. Since the rotor blades are up to 60 m long, such turbines are subjected to enormous forces in stormy wind conditions.

Ways must be found to manage these forces. The nacelle therefore contains mechanical components that are electronically controlled. This ensures that the rotor and rotor blades are always optimally positioned relative to the wind. In extreme situations, the forces acting on the construction can be reduced by adjustment of the rotor blades.

Figure 1
Nacelle adjustment system

Requirements

Slewing drives have proved successful for aligning the rotor in the direction of the wind. The slewing drive, also known as a “yaw drive”, must be very compact but must also have very high operational security, be of a robust design and require very little maintenance.

The drive has a four-stage planetary gearbox. This type of gearbox is characterised by the space-saving construction with coaxially arranged components in the planetary set.

The planetary sets 1 and 2 transmit high and moderate drive speeds under low load. On the output side, incorporating the planetary sets 3 and 4, moderate and high moments are present at low speeds.

The output bearing on the single-piece output pinion shaft is subjected to high radial forces as a result of the high torques.

Operating data

Data		
Ratio		i = 1 428,2
Output torque	nominal	15 300 Nm
	max.	25 000 Nm

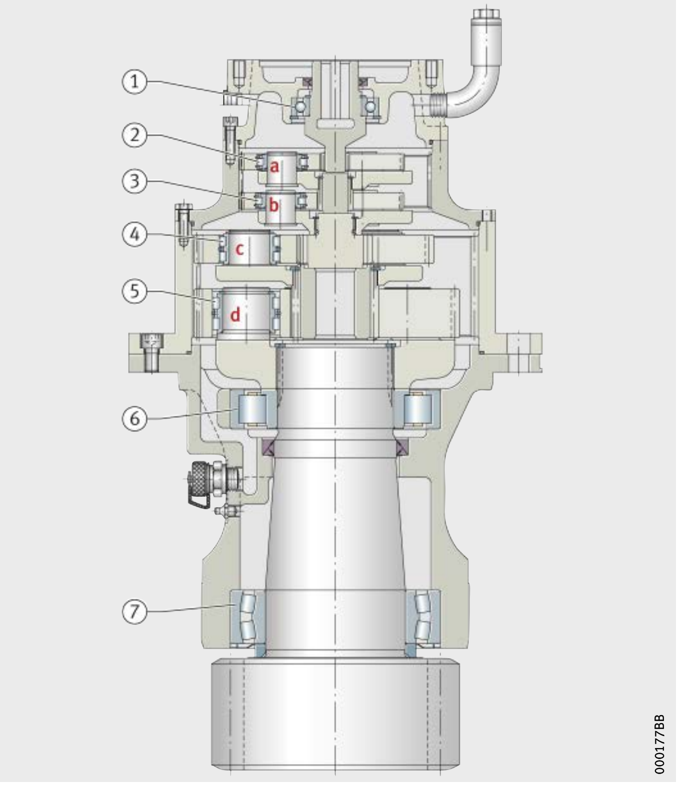
Design solution

The input shaft is supported by a single row deep groove ball bearing. Due to their low frictional torque, these are suitable for high speeds.

The planetary gears are supported by full complement single row and double row cylindrical roller bearings. The single row bearings in stages 1 and 2 are designed for high speeds at low load, while the double row bearings in stages 3 and 4 are designed for high loads at low speed. The rolling elements then run directly in the bore of the planetary gears. As a result, the bearings require very little space. The full complement design ensures high load carrying capacity.

The output shaft is supported in a cylindrical roller bearing (axially free) and a spherical roller bearing (locating bearing). The cylindrical roller bearing has a roller set with increased capacity and is thus designed for extremely high radial load carrying capacity.

The spherical roller bearing on the pinion side supports axial loads from both directions as well as high radial loads and compensates shaft deflections and misalignment of the bearing seats.



a = planetary stage 1
b = planetary stage 2
c = planetary stage 3
d = planetary stage 4

Figure 2
Bearing positions
in pitch and yaw gearbox

Products used

- ① Deep groove ball bearing 6009
- ②, ③ Full complement single row cylindrical roller bearings RSL (special design)
- ④, ⑤ Full complement double row cylindrical roller bearings RSL (special design)
- ⑥ Cylindrical roller bearing NJ220-E.M1 (as non-locating bearing)
- ⑦ Spherical roller bearing 23024-E1A-M (locating bearing)

Hydraulic drive unit

Hydraulic compact drives are used as traction drives in tracklaying and wheeled vehicles.

The drive and integrated hydraulic motor is located opposite the idler wheel and is responsible for driving the chain or wheel. The integrated multi-disc stop brake ensures that the device is stopped securely.

Picture source:
Bosch Rexroth AG

Figure 1
Hydraulic drive unit

Requirements

The traction drive has a multi-stage planetary gearbox.

The planetary stage 1 transmits high drive speeds under low load while the planetary stage 2 on the output side transmits high moments at low speeds.

The planetary stages transmit the force to the ring gear, which can also serve as the wheel hub of the machine.

Traction drives often work for long periods and under extremely challenging conditions. Nevertheless, they must have very high operational security and require very little maintenance.

Operating data

Data	
Ratio	16 – 1 200
Drive moment	7 000 Nm – 1 300 000 Nm

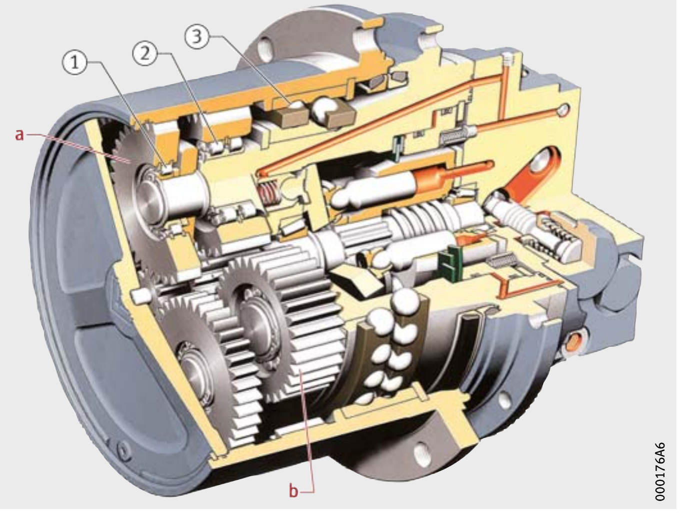
Design solution

One of the challenges in relation to traction drives is the limited space. The planetary gears are therefore supported by full complement cylindrical roller bearings without outer rings.
The rolling elements thus run directly in the bore of the planetary gears. As a result, the bearings require very little radial space.

The full complement design ensures high load carrying capacity. The bearings are axially located in the planetary gear by means of retaining rings. In order to reduce the notch stresses in the planet pin, the bearing inner rings have a larger radius on one side.

Robust support of the main bearing is made possible by a low-clearance angular contact ball bearing with a cage. In the case of very high loads, angular contact roller bearings preloaded clearance-free or tapered roller bearings in an O arrangement can alternatively be used.

Operation free from clearance improves the load carrying capacity of the tooth set and ensures quiet, uniform running.



a = planetary stage 1
b = planetary stage 2

Figure 2
Bearing positions in the traction drive

Products used

1. Full complement single row cylindrical roller bearing without outer ring RN (special design)
2. Full complement double row cylindrical roller bearing RNN with two axial washers and one snap ring (special design)
3. Double row low-clearance angular contact ball bearing with cage
   Alternatively: two tapered roller bearings 302, 322 in O arrangement

Slewing gear drive for crawler excavators

The slewing gear drive is used in the latest generation of hydraulic crawler excavators and is arranged between the upper and lower structure. The teeth on the output shaft mesh with the teeth on a slewing ring to give slewing and rotary motion of the upper structure. The drive is powered by a hydraulic motor. The slewing stop mechanism is controlled by a multi-disc holding brake.

Picture source:
Liebherr-Werke Biberach GmbH

Figure 1
Slewing gear drive

Requirements

The slewing ratio is provided by means of a multi-stage planetary gearbox. This type of gearbox is characterised by its highly compact construction with coaxially arranged components in the planetary set.

The planetary stage 1 transmits high drive speeds under low load while the planetary stage 2 on the output side transmits high moments at low speeds.

The output bearing on the single-piece output pinion shaft is subjected to high radial forces as a result of the high torques.

Slewing gear drives operate on a daily basis under extreme conditions. They must have very high operational security and require very little maintenance.

Operating data

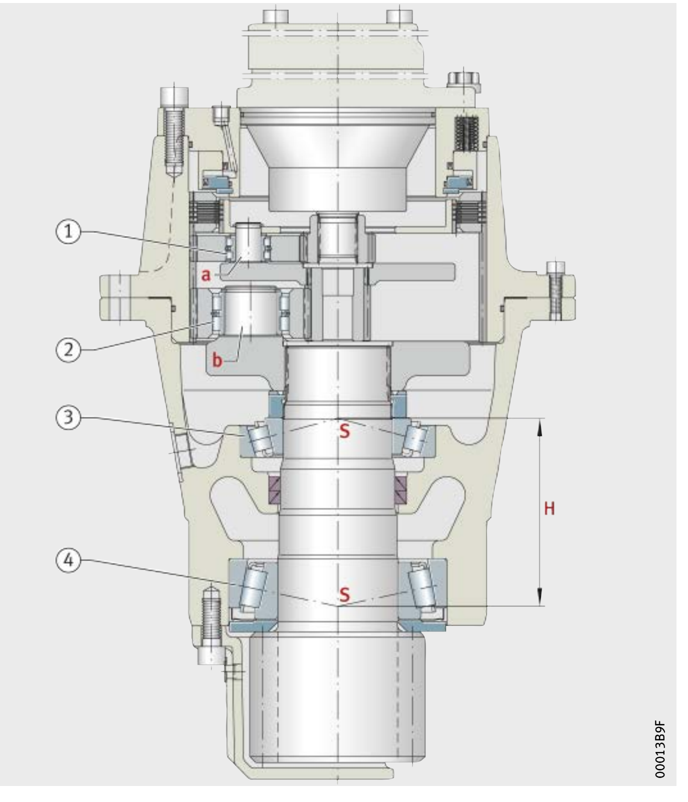
Data			
Ratio		31,7	
Maximum drive moment	dynamic (in operation)	8 100	Nm
	static	10 500	Nm

Design solution

The planetary gears are supported by full complement double row cylindrical roller bearings. The rolling elements run directly in the bore of the planetary gears. As a result, the bearings require very little space. The full complement design ensures the necessary high load carrying capacity. In order to reduce the notch stresses in the planet pin, the inner rings have a larger radius on one side. The bearings are axially located in the planetary gear by means of retaining rings.

The output pinion shaft is supported by two tapered roller bearings adjusted clearance-free in an O arrangement. The support base H, the distance between the apexes of the contact cones, is wider in the O arrangement than in an X arrangement. Operation free from clearance improves the load carrying capacity of the pinion/slewing ring tooth arrangement. As semi-locating bearings, the bearings can support axial forces in one direction and high radial forces. The output bearing provides an axial counterstay and supports the high radial loads present at the pinion as a result of the large torques.

The input bearing on the pinion shaft is lubricated by the oil splash lubrication of the planetary gearbox and requires no further maintenance. The output bearing is greased for life.



a = planetary stage 1
b = planetary stage 2
H = support base
S = apexes of the contact cones

Figure 2
Bearing positions
in the slewing gear drive

Products used

①, ② Full complement cylindrical roller bearings without outer ring RNN (special design)

③, ④ Tapered roller bearings 302, 322 in O arrangement

Planetary gearbox with front-mounted spur gear stage

Planetary gearboxes with a front-mounted spur gear stage are used in various industrial sectors. When used in roll mill drives, they are not only an effective technical component but also a highly economical design solution.

Such a drive is economical thanks to its modular concept in which numerous basic parts can be standardised. These include not only the planetary stages and housing parts but also input and output components.

Picture source: Siemens AG

Figure 1
Roll mill drive

Requirements

The output power is provided by the multi-stage planetary gearbox. High manufacturing accuracies and simulation methods such as FEM ensure optimised distribution of load across the planetary gears.

The front-mounted spur gear stage transmits high drive speeds under low load to the preliminary stage. High moments must be transmitted at low speeds in the main stage.

Operating data

Data	
Ratio	25 – 4 000
Output power	30 kW – 13 000 kW
Torque	22 000 Nm – 2 600 000 Nm

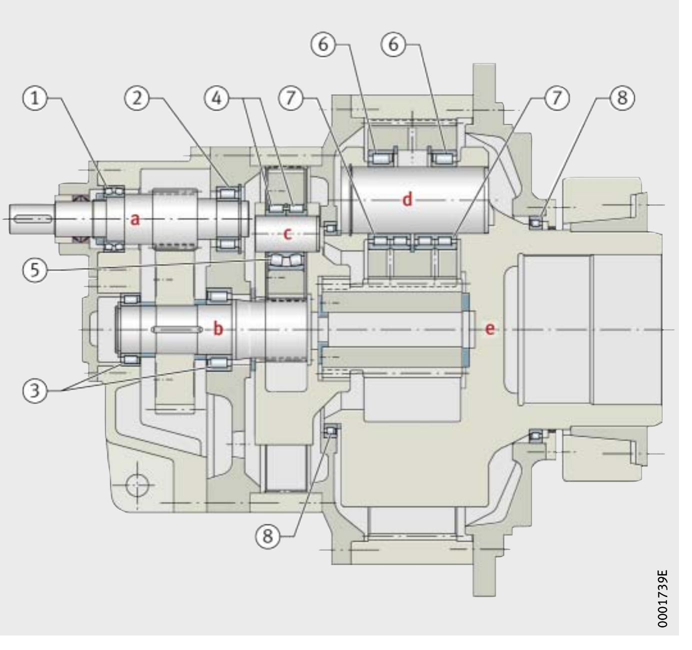
Design solution

The input shaft is supported by a spherical roller bearing as a locating bearing and a cylindrical roller bearing as a non-locating bearing. High speeds under low load are transmitted from a hydraulic motor to the shaft. The spur gear stage with straight teeth comprises the input shaft and the intermediate shaft.

The planetary gears in the preliminary stage are guided by two full complement cylindrical roller bearings RN-2S without outer ring. These bearings offer high rigidity and are easy to mount. An economical alternative would be a spherical roller bearing if the required rigidity of the construction is not too high.

Two full complement single row cylindrical roller bearings SL1830 act as semi-locating bearings and are arranged on the outer sides in the planetary gears of the main stage. These bearings have high load carrying capacity, In order to achieve the maximum possible load carrying capacity and rigidity, double row cylindrical roller bearings SL1850..2S-BR-C3 (sorted as semi-locating bearings) may be used as an alternative. Bearings with the suffix BR have a black oxide coating. This improves the wear resistance of the bearing.

The output shaft is supported by two semi-locating bearings SL1818.



a = input shaft
b = intermediate shaft
c = preliminary stage
d = main stage
e = output shaft

Figure 2
Bearing positions in the planetary gearbox

Products used

- ① Spherical roller bearing (locating bearing)
- ② Cylindrical roller bearing (non-locating bearing)
- ③ Cylindrical roller bearing (semi-locating bearing)
- ④, ⑤ Full complement cylindrical roller bearings RN-2S, without outer ring, ④
  alternatively: spherical roller bearing, ⑤
- ⑥, ⑦ Full complement single row cylindrical roller bearings SL1830, ⑥
  alternatively: double row cylindrical roller bearing SL1850-2S, ⑦
- ⑧ Cylindrical roller bearing SL1818 (semi-locating bearing)

Addresses

Argentina

Schaeffler Argentina S.R.L.
Av. Alvarez Jonte 1938
C1416EXR Buenos Aires
Tel. +(54) 11 / 40 16 15 00
Fax +(54) 11 / 45 82 33 20
info-ar@schaeffler.com

Armenia

Schaeffler Ukraine GmbH
Zhylyanskaya Str. 75, 5. Stock,
Businesscenter «Eurasia»
01032 Kiew
Ukraine
Tel. +(380) 44 520 13 80
Fax +(380) 44 520 13 81
info.ua@schaeffler.com

Australia

Schaeffler Australia Pty Ltd
Level 1, Bldg 8, Forest Central
Business Park
49 Frenchs Forest Road
Frenchs Forst, NSW 2086
Tel. +(61) 2 8977 1000
Fax +(61) 2 9452 4242
sales.au@schaeffler.com

Schaeffler Australia Pty Limited
Suite 14, Level 3
74 Doncaster Road
North Balwyn, VIC 3104
Tel. +(61) 3 9859 8020
Fax +(61) 3 9859 8767
milos.grujic@schaeffler.com

Schaeffler Australia Pty Ltd
Unit 3, 47 Steel Place
Morningside, QLD 4170
Tel. +(61) 7 3399 9161
Fax +(61) 7 3399 9351
martin.grosvenor@schaeffler.com

Austria

Schaeffler Austria GmbH
Ferdinand-Pölzl-Straße 2
2560 Berndorf-St. Veit
Tel. +(43) 2672 202-0
Fax +(43) 2672 202-1003
info.at@schaeffler.com

Belarus

Schaeffler Technologies GmbH & Co. KG
Repräsentanz Weißrussland
Odoewskogo 117, office 317
220015 Minsk
Tel. +(375) 17 269 94 81
Fax +(375) 17 269 94 82
info.by@schaeffler.com

Belgium

Schaeffler Belgium S.P.R.L./B.V.B.A.
Avenue du Commerce, 38
1420 Braine L'Alleud
Tel. +(32) 2 3 89 13 89
Fax +(32) 2 3 89 13 99
info.be@schaeffler.com

Bolivia

Schaeffler Chile Ltda.
Jose Tomas Rider 1051
Providencia
7501037 Santiago
Chile
Tel. +(56) 2 477 5000
Fax +(56) 2 435 9079
sabine.heijboer@schaeffler.com

Bosnia-Herzegovina

Schaeffler Hrvatska d.o.o.
Ogrizovićeva 28b
10000 Zagreb
Croatia
Tel. +(385) 1 37 01 943
Fax +(385) 1 37 64 473
info.hr@schaeffler.com

Brazil

Schaeffler Brasil Ltda.
Av. Independência, 3500-A
Bairro Éden
18087-101 Sorocaba, SP
Tel. 0800 11 10 29
Fax +(55) 1533 35 19 60
sac.br@schaeffler.com

Bulgaria

Schaeffler Bulgaria OOD
Dondukov-Blvd. No 62
Eing. A, 6. Etage, App. 10
1504 Sofia
Tel. +(359) 2 946 3900
+(359) 2 943 4008
Fax +(359) 2 943 4134
info.bg@schaeffler.com

Canada

Schaeffler Canada Inc.
100 Alexis Nihon Suite 390
Montréal, QC H4M 2N8
Tel. +(1) 514-748-5111
800-361-5841 Toll Free
Fax +(1) 514-748-6111
info.ca@schaeffler.com

Schaeffler Canada Inc.
2871 Plymouth Drive
Oakville, ON L6H 5S5
Tel. +(1) 905-829-2750
800-263-4397 Toll Free
Fax +(1) 905-829-2563
info.ca@schaeffler.com

Schaeffler Canada Inc.
#106, 7611 Sparrow Drive
Leduc, AB T9E 0H3
Tel. +(1) 780-980-3016
800-663-9006 Toll Free
Fax +(1) 780-980-3037
info.ca@schaeffler.com

Chile

Schaeffler Chile Rodamientos Ltda.
Jose Tomas Rider 1051
Providencia
7501037 Santiago
Tel. +(56) 2 477 5000
info-cl@schaeffler.com

China

Schaeffler Holding (China) Co., Ltd.
No. 1 Antuo Road
(west side of Anhong Road)
AnTing, JiaDing District
201804 Shanghai
Tel. +(86) 21 3957 6666
Fax +(86) 21 3957 6600
info_china@schaeffler.com

Colombia

Schaeffler Colombia Ltda.
Cra. 10 N° 97A 13 Torre A
Ofic 209 Bogotá Trade Center
Bogotá
Tel. +(57) 1 621 53 00
Fax +(57) 1 621 03 22
info-co@schaeffler.com

Croatia

Schaeffler Hrvatska d.o.o.
Ogrizovićeva 28b
10000 Zagreb
Tel. +(385) 1 37 01 943
Fax +(385) 1 37 64 473
info.hr@schaeffler.com

Czech Republic

Schaeffler CZ s.r.o.
Průběžná 74a
100 00 Praha 10
Tel. +(420) 267 298 111
Fax +(420) 267 298 110
info.cz@schaeffler.com

Denmark

Schaeffler Danmark ApS
Jens Baggesens Vej 90P
8200 Aarhus N
Tel. +(45) 70 15 44 44
Fax +(45) 70 15 22 02
info.dk@schaeffler.com

Egypt

Delegation Office
Schaeffler Technologies
25, El Obour Buildings – Floor 18 – Flat 4
Salah Salem St.
11371 Cairo
Tel. +(20) 2 24012432
Fax +(20) 2 22612637
schaeffleregypt@schaeffleregypt.com

Estonia

Schaeffler Technologies
Repräsentanz Baltikum
Duntes iela 23a
1005 Riga
Latvia
Tel. +(371) 67 06 37 95
Fax +(371) 67 06 37 96
info.lv@schaeffler.com

Finland

Schaeffler Finland Oy
Lautamiehentie 3
02770 Espoo
Tel. +(358) 207 36 6204
Fax +(358) 207 36 6205
info.fi@schaeffler.com

France

Schaeffler France SAS
93, route de Bitche, BP 30186
67506 Haguenau
Tel. +(33) 3 88 63 40 40
Fax +(33) 3 88 63 40 41
info.fr@schaeffler.com

Germany

Schaeffler Technologies GmbH & Co. KG
Industriestraße 1 – 3
91074 Herzogenaurach
Tel. +(49) 9132 82-0
Fax +(49) 9132 82-4950
info.de@schaeffler.com

Schaeffler Technologies GmbH & Co. KG
Georg-Schäfer-Str. 30
97421 Schweinfurt
Tel. +(49) (9721) 91-0
Fax +(49) (9721) 91-3435
faginfo@schaeffler.com

Schaeffler Technologies GmbH & Co. KG
Geschäftsbereich Lineartechnik
Berliner Straße 134
66424 Homburg (Saar)
Tel. +(49) 6841 701-0
Fax +(49) 6841 701-2625
info.linear@schaeffler.com

FAG Aerospace GmbH & Co. KG
Georg-Schäfer-Str. 30
97421 Schweinfurt
Tel. +49 (0 97 21) 91-33 72
astrid.hofmann@schaeffler.com

Hungary

Schaeffler Magyarország Ipari Kft.
Rétköz u.5
1118 Budapest
Tel. +(36) 1 4 81 30 50
Fax +(36) 1 4 81 30 53
budapest@schaeffler.com

India

FAG Bearings India Limited
Maneja
Vadodara 390 013
Tel. +(91) 26 52 6426-51
Fax +(91) 26 52 6388-04/-10
info.fag.in@schaeffler.com

Italy

Schaeffler Italia S.r.l.
Via Dr. Georg Schaeffler, 7
28015 Momo (Novara)
Tel. +(39) 3 21 92 92 11
Fax +(39) 3 21 92 93 00
info.it@schaeffler.com

Japan

Schaeffler Japan Co., Ltd.
New Stage Yokohama 1-1-32
Shinurashima-cho
221-0031 Yokohama
Tel. +(81) 45 274 8211
Fax +(81) 45 274 8221
info-japan@schaeffler.com

Korea

Schaeffler Korea Corporation –
Guro Office
A-501, 1258, Guro-dong, Guro-gu,
Seoul, 152-721
Tel. +(82) 2 2625-8572
Fax +(82) 2 2611-6075

Latvia

Schaeffler Technologies
Repräsentanz Baltikum
Duntes iela 23a
1005 Riga
Tel. +(371) 7 06 37 95
Fax +(371) 7 06 37 96
info.lv@schaeffler.com

Lithuania

Schaeffler Technologies
Repräsentanz Baltikum
Duntes iela 23a
1005 Riga
Latvia
Tel. +(371) 7 06 37 95
Fax +(371) 7 06 37 96
info.lv@schaeffler.com

Luxembourg

Schaeffler Belgium S.P.R.L./B.V.B.A.
Avenue du Commerce, 38
1420 Braine L'Alleud
Belgium
Tel. +(32) 2 3 89 13 89
Fax +(32) 2 3 89 13 99
info.be@schaeffler.com

Malaysia

Schaeffler Bearings (Malaysia) Sdn. Bhd.
5-2 Wisma Fiamma, No. 20 Jalan 7A/62A
Bandar Menjalara
52200 Kuala Lumpur
Tel. +(60) 3-6275 0620
Fax +(60) 3 6275 6421
marketing_my@schaeffler.com

Schaeffler Bearings (Malaysia) Sdn. Bhd.
(Penang Branch)
No. B-02-28, 2nd Floor, Krystal Point
303, Jalan Sultan Azlan Shah
11900 Sungai Nibong
Tel. +(60) 4 642 3708/3781
Fax +(60) 4 642 3724

Mexico

INA México, S.A. de C.V. -
Rodamientos FAG, S.A. de C.V.
Henry Ford #141
Col. Bondojito
Deleg. Gustavo A. Madero
07850 Mexico D.F.
Tel. +(52) 55 5062 6085
Fax +(52) 55 5739 5850
distr.indl.mx@schaeffler.com

Addresses

Netherlands

Schaeffler Nederland B.V.
Gildeweg 31
3771 NB Barneveld
Tel. +(31) 342 40 30 00
Fax +(31) 342 40 32 80
info.nl@schaeffler.com

New Zealand

Schaeffler New Zealand
(Unit R, Cain Commercial Centre)
20 Cain Road
1135 Penrose
Tel. +(64) 9 583 1280
+(64) 021 324 247
(Call out fee applies)
Fax +(64) 9 583 1288
sales.nz@schaeffler.com

Norway

Schaeffler Norge AS
Grenseveien 107B
0663 Oslo
Tel. +(47) 23 24 93 30
Fax +(47) 23 24 93 31
info.no@schaeffler.com

Philippines

Schaeffler Philippines Inc
5th Floor, Optima Building
221 Salcedo Street, Legaspi Village
1229 Makati City
Tel. +(63) 2 759 3583
Fax +(63) 2 759 3578
marketing_ph@schaeffler.com

Schaeffler Philippines Inc –
Branch Office
Unit A- 202, S.A Bldg.,
Plaridel St., Alang-Alang,
Mandaue City
Tel. +(63) 32 236 2404
Fax +(63) 32 344 3644

Poland

Schaeffler Polska Sp. z o.o.
Budynek E
ul. Szyszkowa 35/37
02-285 Warszawa
Tel. +(48) 22 8 78 41 20
Fax +(48) 22 8 78 41 22
info.pl@schaeffler.com

Portugal

INA Rolamentos Lda.
Arrábida Lake Towers
Rua Daciano Baptista Marques Torre C,
181, 2º piso
4400-617 Vila Nova de Gaia
Tel. +(351) 22 5 32 08 00
Fax +(351) 22 5 32 08 60
info.pt@schaeffler.com

Romania

S.C. Schaeffler Romania S.R.L.
Aleea Schaeffler Nr. 3
507055 Cristian/Brasov
Tel. +(40) 268 505000
Fax +(40) 268 505848
info.ro@schaeffler.com

Russia

Schaeffler Russland GmbH
Leningradsky Prospekt 47, Bau 3
Business-Center Avion
125167 Moscow
Tel. +(7) 495 7 37 76 60
Fax +(7) 495 7 37 76 61
info.ru@schaeffler.com

Saudi Arabia

Schaeffler Middle East FZE
Road SE101, Schaeffler Building
Jebel Ali Free Zone – Southside
Postbox 261808
Dubai UAE
United Arab Emirates
Tel. +(971) 4 81 44 500
Fax +(971) 4 81 44 601
info.ae@schaeffler.com

Serbia

Schaeffler Technologies
Repräsentanz Serbien
Branka Krsmanovica 12
11118 Beograd
Tel. +(381) 11 308 87 82
Fax +(381) 11 308 87 75
fagbgdyu@sezampro.yu

Singapore

Schaeffler (Singapore) Pte. Ltd.
151 Lorong Chuan, #06-01
New Tech Park, Lobby A
556741 Singapore
Tel. +(65) 6540 8600
Fax +(65) 6540 8668
info.sg@schaeffler.com

Slovak Republic

Schaeffler Slovensko, spol. s r.o.
Ulica Dr. G. Schaefflera 1
02401 Kysucké Nové Mesto
Tel. +(421) 41 4 20 59 11
Fax +(421) 41 4 20 59 18
info.sk@schaeffler.com

Schaeffler Slovensko, spol. s r.o.
Nevädzova 5
821 01 Bratislava
Tel. +(421) 2 43 294 260
Fax +(421) 2 48 287 820
info.sk@schaeffler.com

Slovenia

Schaeffler Slovenija d.o.o.
Glavni trg 17/b
2000 Maribor
Tel. +(386) 2 22 82 070
Fax +(386) 2 22 82 075
info@schaeffler.si

South Africa

Schaeffler South Africa (Pty.) Ltd.
1 End Street Ext. Corner Heidelberg Road
2000 Johannesburg
Tel. +(27) 11 225 3000
Fax +(27) 11 334 1755
info.co.za@schaeffler.com

Spain

Schaeffler Iberia, s.l.u. –
División Industria
C/ Foment, 2
Polígono Ind. Pont Reixat
08960 Sant Just Desvern – Barcelona
Tel. +(34) 93 4 80 34 10
Fax +(34) 93 3 72 92 50
info.es@schaeffler.com

Sweden

Schaeffler Sverige AB
Charles gata 10
195 61 Arlandastad
Tel. +(46) 8 59 51 09 00
Fax +(46) 8 59 51 09 60
info.se@schaeffler.com

Switzerland

HYDREL GmbH
Badstrasse 14
8590 Romanshorn
Tel. +(41) 71 4 66 66 66
Fax +(41) 71 4 66 63 33
info.ch@schaeffler.com

Taiwan

Schaeffler Taiwan Co. Ltd.
23F, No.76, Sec. 2, Dunhua S. Rd.,
Da’an Dist.
Taipei 106
Tel. +886 2 7730 1911
Fax +886 2 2707 9964
info.tw@schaeffler.com

M.Hsieh`s Industry Corp.
1 F, No. 121, Section 1
Heping East Road
Taipei 10644
Tel. +886 2 3322 5699
Fax +886 2 3322 5700
mhina@mhina.com.tw

Thailand

Schaeffler (Thailand) Co., Ltd.
388 Exchange Tower, 34th Floor
Sukhumvit Road, Klongtoey
Bangkok, 10110
Tel. +(66) 2697 0000
Fax +(66) 2697 0001
info.th@schaeffler.com

Turkey

Schaeffler Rulmanlari Ticaret Limited Sirketi
Aydin Sokak Dagli Apt. 4/4
1. Levent
34340 Istanbul
Tel. +(90) 212 2 79 27 41
+(90) 212 280 77 98
Fax +(90) 212 281 66 45
+(90) 212 280 94 45
info.tr@schaeffler.com

Ukraine

TOV Schaeffler Ukraine
Jilyanskayastr. 75, 5-er Stock
Bussines Center «Eurasia»
01032 Kiew
Tel. +(380) 44-5201380
Fax +(380) 44-5201381
info.ua@schaeffler.com

United Kingdom

Schaeffler (UK) Ltd
Forge Lane, Minworth
Sutton Coldfield B76 1AP
Tel. +(44) 121 3 13 58 70
Fax +(44) 121 3 13 00 80
info.uk@schaeffler.com

The Barden Corporation (UK) Limited
Plymbridge Road, Estover
Plymouth, PL6 7LH
Tel. +(44) 1752 73 55 55
Fax +(44) 1752 73 34 81
bardenbearings@schaeffler.com

United Arab Emirates

Schaeffler Middle East FZE
Road SE101, Schaeffler Building
Jebel Ali Free Zone - Southside
Postbox 261808
Dubai UAE
Tel. +971 4 81 44 500
Fax +971 4 81 44 601
ousama.abukhader@schaeffler.com

USA

Schaeffler Group USA Inc.
200 Park Avenue
P.O. Box 1933
Danbury, CT 06813-1933
Tel. +(1) 203 790 5474
Fax +(1) 203 830 8171
Walter.Newton@schaeffler.com

The Barden Corporation
200 Park Avenue
P.O. Box 2449
Danbury, CT 06813-2449
Tel. +(1) 203 744 2211
Fax +(1) 203 744 3756
sales@bardenbearings.com

Schaeffler Group USA Inc.
308 Springhill Farm Road
Corporate Offices
Fort Mill, SC 29715
Tel. +(1) 803 548 8500
Fax +(1) 803 548 8599
info.us@schaeffler.com

Schaeffler Group USA Inc.
5370 Wegman Drive
Valley City, OH 44280-9700
Tel. +(1) 800 274 5001
Fax +(1) 330 273 3522
luk-ina-fag-as.us@schaeffler.com

Venezuela

Schaeffler Venezuela C.A.
Urbanización San José de Tarbes
Torre BOD, Piso 14, Oficina 14-1
Valencia
Tel. +(58) 58 241 825 9250
Fax +(58) 58 241 825 9705
ana.acevedo@schaeffler.com

Vietnam

Schaeffler Vietnam Co., Ltd –
Ho Chi Minh Sales Office
6th Floor, TMS Building.
172 Hai Ba Trung street, Da Kao Ward, District 1.
Ho Chi Minh City
Tel. +(84) 8 22 20 2777
Fax +(84) 8 22 20 2776
marketing_vn@schaeffler.com

Schaeffler Vietnam Co., Ltd –
Hanoi Sales Office
Charm Vit Tower, 18th Floor
No. 117 Tran Duy Hung Street,
Cau Giay District
Ha Noi
Tel. +(84) 4 3556 0930
Fax +(84) 4 3556 0931
marketing_vn@schaeffler.com

Notes

Notes

Notes

Notes

MATNR 036931586-0000/TPI 08/02/GB-D/2014051/Printed in Germany by hofmann

Schaeffler Technologies GmbH & Co. KG

Industriestraße 1 – 3
91074 Herzogenaurach
Germany
Internet www.ina.com
E-mail info@schaeffler.com

In Germany:
Phone 0180 5003872
Fax 0180 5003873

From other countries:
Phone +49 9132 82-0
Fax +49 9132 82-4950

Schaeffler Technologies GmbH & Co. KG

Georg-Schäfer-Straße 30
97421 Schweinfurt
Germany
Internet www.fag.com
E-mail FAGinfo@schaeffler.com

In Germany:
Phone 0180 5003872
Fax 0180 5003873

From other countries:
Phone +49 9721 91-0
Fax +49 9721 91-3435

Every care has been taken to ensure the correctness of the information contained in this publication but no liability can be accepted for any errors or omissions. We reserve the right to make technical changes.

Issued: 2014, May

TPI 08 GB-D