

Cylindrical roller bearings

Contents

Cylindrical roller bearings	180
Three different designs	180
Double row cylindrical roller bearings	181
Single row cylindrical roller bearings	182
Hybrid cylindrical roller bearings	183
General bearing data	184
Radial internal clearance	188
Preload	189
Equivalent dynamic bearing load	192
Equivalent static bearing load	192
Designation of high-precision cylindrical roller bearings	193
Supplementary designations – specific suffixes	193
Product tables	195
High-precision double row cylindrical roller bearings	196
High-precision single row cylindrical roller bearings	204
Hybrid high-precision single row cylindrical roller bearings	208



Cylindrical roller bearings

Three different designs

SKF high-precision cylindrical roller bearings are available in three different designs: two double row series NN 30 and NNU 49 and a high-speed design, single row cylindrical roller bearing series N 10.

NNU 49 series offer especially compact dimensions and may be preferred when

limited room is available. The NN 30 series offers an optimum compromise between achievable speed and high rigidity and represents one of the more popular choices, particularly for the spindles rear-side support. Whenever demand for rotational speed exceeds the standard series capability, then the single row series N 10 may be the solution.



Double row cylindrical roller bearings

SKF high-precision double row cylindrical roller bearings are available in two different designs: NN (→ fig 1) and NNU (→ fig 2) designs, and two series: Dimension Series 30 and 49 (→ fig 3).

The rollers of NN design bearings are guided between integral flanges on the inner ring, while rollers of NNU design bearings are guided between integral flanges on the outer ring. The other ring has no flanges. This means that a certain amount of axial displacement of the shaft with respect to the housing in both directions can be accommodated within the bearing (see dimension 's' in the product tables).

These bearings are also separable, and the bearing ring with integral flanges, together with the roller and cage assembly, can be withdrawn from the flangeless ring. This facilitates mounting and dismounting.

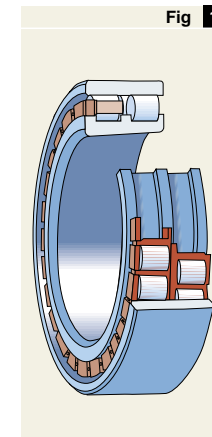
The NN design bearings listed in this catalogue follow ISO Dimension Series 30, whereas the NNU design bearings follow ISO Dimension Series 49. Bearings of series NNU 49 with their very low cross-section, permit stiffer bearing arrangements than those of series NN 30, but are not able to carry such heavy loads as the NN 30 series bearings.

SKF double row cylindrical roller bearings are available with either cylindrical bore or tapered bore (with a taper 1:12). In the machine tool industry, cylindrical roller bearings are generally supplied with a tapered bore, as this design allows a certain radial internal clearance or preload to be achieved by adjustment, when mounting bearings on a tapered shaft.

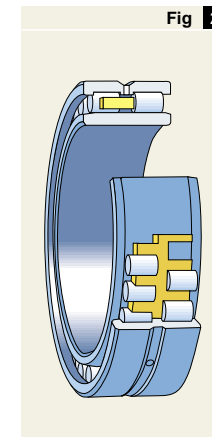
In order to facilitate efficient lubrication, bearings of series NNU 49, that have very low cross section, have an annular groove and three lubrication holes in the outer ring as standard (W33 designation). Oil spot pipes can be either inserted in the holes in



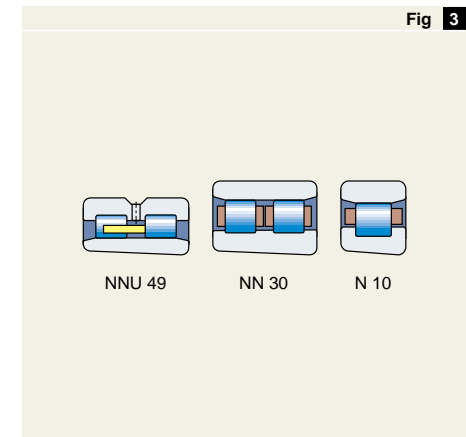
Double row high-precision cylindrical roller bearing, NN design



Double row high-precision cylindrical roller bearing, NNU design



A cross section of the two dimension series



3 Cylindrical roller bearings

the annular groove, or positioned at the side of the bearings at a height specified in the table shown in the lubrication section of this publication. Bearings of series NN 30, that are mostly used in the machine tool spindles, are manufactured without this feature as the oil is commonly injected through pipes positioned at the side of the bearing. For special applications where bearings of the NN 30 series with the annular groove and the three lubrication holes in the outer ring are necessary, please contact the SKF applications engineering service.

In cases where demand for running accuracy is exceptionally high, it is possible to mount the flangeless ring of bearings of series NNU 49, on to the shaft and to finish-grind the raceway and other seating surfaces of the shaft.

For such applications, SKF can supply bearings of series NNU 49 having a tapered bore fitted with inner rings with pre-ground raceways. Such bearings are identified by the designation suffix VU001 (→ **Table 1**).

Single row cylindrical roller bearings

The single row bearings series N 10 (→ **fig 4**) have the same section height as the double row bearings of series NN 30 and follow ISO Dimension Series 10. The rollers of series N 10 bearings are guided between two integral flanges on the inner ring; the outer ring is without flanges. It is therefore possible for a certain amount of axial displacement of the shaft with respect to the housing to be accommodated within the bearing (see bearing tables). They are available with a tapered bore only (taper 1:12) and as with double row bearings, single row bearings are separable, i.e. the inner ring with roller and cage assembly can be withdrawn from the flangeless outer ring.

High-precision single row cylindrical roller bearings are designed for bearing arrangements with different requirements from those for double row cylindrical roller bearings. Instead of very high load carrying capacity, single row cylindrical roller bearings are used where increased speed capability and more compact spindle design are needed.

Hybrid cylindrical roller bearings

SKF high-precision cylindrical roller bearings series NN 30 and N 10 can be delivered with ceramic rollers when the performances required cannot be met by all-steel bearings. As mentioned for hybrid high-precision angular contact ball bearings, hybrid cylindrical roller bearings can run faster, with lower temperature rise and enhance the system rigidity, without mentioning that they minimise lubrication and vibrations, and are less sensible to accelerations and decelerations. In order to exploit the best possibilities in terms

of speed, the use of ceramic rollers is normally matched with that of a one-piece outer ring and riding PEEK cage.

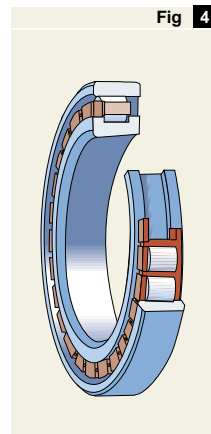
High-precision single row cylindrical roller bearings with a PEEK cage and ceramic rollers can reach a reference speed of 2 million $n \times d_m$ when lightly loaded and oil-air lubricated, and of 1,4 million $n \times d_m$ when grease lubricated. As an option to further improve lubricant flow, bearings of series N 10 with special holes in the outer ring may be ordered.

Hybrid cylindrical roller bearings are identified by the suffix HC5 in the bearing designation.

Table 1

Bearing bore diameter		Grinding allowance
over	incl.	
mm		mm
–	110	0,2
110	360	0,3
360	–	0,4

Fig 4



Single row high-precision cylindrical roller bearing

General bearing data

Dimensions

The boundary dimensions of the double row bearings shown in the tables conform to ISO 15:1998, Dimension Series 49 and 30. Single row bearings conform to ISO Dimension Series 10.

Tolerances

SKF high-precision cylindrical roller bearings are produced as standard to the tolerance class SP (special precision) specifications

needed for machine tool applications. Tolerance class SP specifies dimensional accuracy which corresponds approximately to tolerance class P5 and running accuracy to P4. For special applications where extreme precision is required, tolerance class UP (ultra precision) can be supplied to order. Tolerance class UP specifies dimensional accuracy which corresponds approximately to tolerance class P4 and running accuracy better than P4.

The values for class SP and UP tolerances are given in **Tables 3, 4 page 186 and 5 page 187.**

Measuring of angle deviation

Tapered bore

Half angle of taper $\alpha = 2^\circ 23' 9,4''$

Largest theoretical taper $d_1 = d + \frac{1}{12} B$

Fig 5

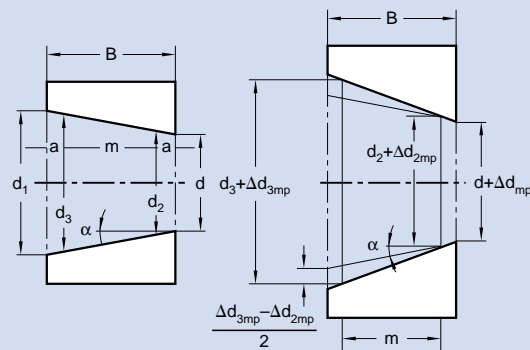


Table 2

Chamfer dimension, $r_{2 \min}^{(1)}$	Bearing bore diameter d		Measuring distance a
	over	incl.	
mm	mm	mm	mm
0,6	–	–	2,5
1	–	–	3,5
1,1	–	120	4
1,5	120	–	5
	–	120	5
2	120	–	6
	–	80	5,5
	80	220	6
2,1	220	–	7
	–	280	7,5
2,5	280	–	8,5
	–	280	7,5
3	280	–	8,5
4	–	–	9,5
	–	–	11

¹⁾ $r_{2 \min}$ values are given in the product tables (→ pages 195–211)

Angle deviation – measuring distance a

Tolerances for tapered bore, taper 1:12

Table 3

d over	incl.	Tolerance class SP			Tolerance class UP						
		Δd_{2mp} high	low	V_{dp} max	Δd_{2mp} high	low	V_{dp} max	$\Delta d_{3mp} - \Delta d_{2mp}^{1)}$ high	low		
mm		μm		μm	μm		μm		μm		
18	30	+10	0	3	+4	+1	+6	0	2	+3	+1
30	50	+12	0	4	+4	+1	+8	0	3	+3	+1
50	80	+15	0	5	+4	+1	+9	0	3	+3	+1
80	120	+20	0	5	+7	+2	+10	0	4	+4	+1
120	180	+25	0	7	+7	+2	+13	0	5	+4	+1
180	250	+30	0	8	+8	+2	+15	0	7	+5	+1
250	315	+35	0	9	+10	+2	+18	0	9	+5	+1

¹⁾ Angular deviation over measuring length m (→ fig 5 and Table 2)

3 Cylindrical roller bearings

Table 4

Inner ring									
d	incl.	Δ_{ds}		V_{dp}	Δ_{Bs}		V_{Bs}	K_{ia}	S_d
over		high	low	max	high	low	max	max	max
mm		μm		μm	μm		μm	μm	μm
–	18	0	–5	3	0	–100	5	3	8
18	30	0	–6	3	0	–100	5	3	8
30	50	0	–8	4	0	–120	5	4	8
50	80	0	–9	5	0	–150	6	4	8
80	120	0	–10	5	0	–200	7	5	9
120	180	0	–13	7	0	–250	8	6	10
180	250	0	–15	8	0	–300	10	8	11
250	315	0	–18	9	0	–350	13	8	13
Outer ring									
D	incl.	Δ_{Ds}		V_{Dp}	Δ_{Cs}		V_{Cs}	K_{ea}	S_D
over		high	low	max	high	low	max	max	max
mm		μm		μm	μm		μm	μm	μm
30	50	0	–7	4	Values are identical to those for inner ring of same bearing		5	5	8
50	80	0	–9	5		6	5	8	
80	120	0	–10	5		7	6	9	
120	150	0	–11	6		7	7	10	
150	180	0	–13	7		8	8	10	
180	250	0	–15	8		10	10	11	
250	315	0	–18	9		13	11	13	
315	400	0	–20	10		15	13	13	
400	500	0	–23	12	25	15	15		

Class SP tolerances for radial bearings

Table 5

Inner ring									
d	incl.	Δ_{ds}		V_{dp}	Δ_{Bs}		V_{Bs}	K_{ia}	S_d
over		high	low	max	high	low	max	max	max
mm		μm		μm	μm		μm	μm	μm
–	18	0	–4	2	0	–25	1,5	1,5	2
18	30	0	–5	3	0	–25	1,5	1,5	3
30	50	0	–6	3	0	–30	2	2	3
50	80	0	–7	4	0	–40	3	2	4
80	120	0	–8	4	0	–50	3	3	4
120	180	0	–10	5	0	–60	4	3	5
180	250	0	–12	6	0	–75	5	4	6
250	315	0	–18	9	0	–90	6	5	6
Outer ring									
D	incl.	Δ_{Ds}		V_{Dp}	Δ_{Cs}		V_{Cs}	K_{ea}	S_D
over		high	low	max	high	low	max	max	max
mm		μm		μm	μm		μm	μm	μm
30	50	0	–5	3	Values are identical to those for inner ring of same bearing		2	3	2
50	80	0	–6	3		3	3	2	
80	120	0	–7	4		3	3	3	
120	150	0	–8	4		4	4	3	
150	180	0	–9	5		4	4	3	
180	250	0	–10	5		5	5	4	
250	315	0	–12	6		6	6	4	
315	400	0	–14	7		8	7	5	
400	500	0	–23	12	10	8	–		

Class UP tolerances for radial bearings



Radial internal clearance

High-precision cylindrical roller bearings actual clearance limits are in accordance with ISO 5753:1991. Cylindrical roller bearings for precision applications are supplied with C1 radial internal clearance class as standard, although this is not apparent from the bearing designation. The bearing rings of individual bearings must be kept together as supplied, otherwise the bearing clearance may become too great or too small, thus influencing the assembly procedures. The bearings are usually supplied packed in a single box, however, if the rings are packed separately, the rings of each bearing are identified by the same serial number. Bearings of the N 10 and NN 30 series can also be supplied on

request, with reduced radial clearance (smaller than C1) for enhanced precision after mounting. Please consult the SKF application engineering service for more details.

Both series NNU 49 and NN 30 bearings may be supplied with larger radial internal clearance for certain applications, as required. When ordering, the desired clearance should be indicated in the designation using the suffixes SP or UP, followed by the suffix for the requested clearance, C2, CN (for Normal radial clearance) or C3, for example NN 3026 K/SPC2.

Cylindrical roller bearing clearance values are given in **Table 6**. They are valid for unmounted bearings under zero measuring load.

Table 6

Bore diameter		Radial internal clearance Bearings with cylindrical bore								Bearings with tapered bore			
d	over	C1		SPC2		Normal		C3		C1		SPC2	
mm	incl.	min	max	min	max	min	max	min	max	min	max	min	max
		µm		µm		µm		µm		µm		µm	
24	30	5	15	10	25	20	45	35	60	15	25	25	35
30	40	5	15	12	25	25	50	45	70	15	25	25	40
40	50	5	18	15	30	30	60	50	80	17	30	30	45
50	65	5	20	15	35	40	70	60	90	20	35	35	50
65	80	10	25	20	40	40	75	65	100	25	40	40	60
80	100	10	30	25	45	50	85	75	110	35	55	45	70
100	120	10	30	25	50	50	90	85	125	40	60	50	80
120	140	10	35	30	60	60	105	100	145	45	70	60	90
140	160	10	35	35	65	70	120	115	165	50	75	65	100
160	180	10	40	35	75	75	125	120	170	55	85	75	110
180	200	15	45	40	80	90	145	140	195	60	90	80	120
200	225	15	50	45	90	105	165	160	220	60	95	90	135
225	250	15	50	50	100	110	175	170	235	65	100	100	150
250	280	20	55	55	110	125	195	190	260	75	110	110	165

Preload

To ensure maximum running accuracy and rigidity, high-precision cylindrical roller bearings should have, after mounting, a minimum radial internal clearance or a preload. Generally, cylindrical roller bearings with tapered bore are mounted with preload.

The magnitude of the operational clearance or preload depends on the speed, load, lubrication and required stiffness. It is also dependent on the accuracy of form of the bearing seating. Temperature conditions in the bearing should also be taken into consideration, since a reduction in clearance or an increase in preload may result. The following table gives guidelines on preloading cylindrical roller bearings series NN 30 K and N 10 K for machine tool applications. For special cases, please consult SKF.

Speed – n d _m value	Preload/clearance (microns)
≤ 500 000	2 – 5, preload
> 500 000 < 1 000 000	1 – 2, preload
> 1 000 000	0 – 4, clearance

Preloading bearings

The adjustment of clearance, or preload for double and single row cylindrical roller bearings with tapered bore, is achieved by driving up the bearing on its tapered seating. The SKF gauges shown on **pages 286 – 295** enable the internal clearance, or preload to be set very accurately, quickly and reliably.

The use of a gauge is particularly advantageous where series mounting is concerned, as it is then not possible to determine and measure the axial displacement of the inner ring.

If SKF gauges are not available, the axial displacement of the inner ring on its tapered seating must be determined, in accordance with the required clearance or preload. In order to do this the outer ring should be mounted in the housing, the inner ring then pushed on the seating and the residual clearance measured.

Knowing the residual radial clearance, the axial displacement i.e. the additional distance through which the bearing must be pushed up on its tapered seating can be obtained from:

$$B = L - ec/1\ 000$$

where

B = width of spacer, mm

L = measured distance between inner ring side face and abutment, mm

c = measured clearance plus required preload (or minus required clearance), µm

e = factor depending on the ratio of the internal diameter (d_i) and the outside diameter (d) of the hollow spindle **fig 6 page 190**, see table below.

Diameter Ratio d _i /d	Factor e	
	Bearing series NN 30 K & N10 K	NNU 49 BK
≤0,2	12,5	12
0,3	14,5	13
0,4	15	14
0,5	16	15
0,6	17	16
0,7	18	17

3 Cylindrical roller bearings

If a threaded nut is used for driving up the inner ring assembly on the tapered seating, the angle through which the nut should be turned for a given clearance reduction of the bearing can be calculated from the equation:

$$\gamma = 360 e \Delta / (1\,000 s)$$

where

γ = angle of turn of the nut, degrees
 e = factor depending on shaft diameters
 Δ = clearance reduction in bearing, μm
 s = thread lead, mm

A detailed description of the mounting procedure for high-precision cylindrical roller bearings is given in the Mounting Chapter (→ pages 79 – 109).

Cages

SKF double row cylindrical roller bearings are fitted as standard with a single piece machined brass cage, or with two separate pronged cages with cover, made of polyamide. Single row bearings of the series

N 10 K incorporate the same pronged polyamide cages as the corresponding NN 30 K series bearings. Bearings with polyamide cages, NN 3008 to NN 3026 and N 1008 K to N 1024 K (identified by designation suffix TN or TN9), may be used without restriction at the temperatures normally encountered in machine tool operation, up to a maximum of 120°C.

For high-speed applications a 'one piece' design outer ring land-riding cage made of light weight glass fibre reinforced poly-ether-ether-ketone (PEEK) is available. This cage is identified by the suffix TNHA in the designation.

The lubricants generally used for rolling bearings have no detrimental effect on cage properties, with the exception of some synthetic oils and greases based on synthetic oils. If lubricants containing a high proportion of EP additives are used, especially at elevated temperatures, this may affect cage performance. For more details, please consult the SKF application engineering service.

Speed ratings

The speed ratings quoted in the product tables are guideline values that are valid provided the bearings have a maximum preload in operation of 2 μm , and that adjacent components are made with the accuracy prescribed on pages 48 – 50. Where heavier preloads occur, or where the adjacent components are less accurate, the speed ratings must be reduced.

Design of associated components

If bearings of series NN 30 (K) and series N 10 K fitted with a polyamide cage (sizes 08 to 26 inclusive; designation suffix TN or TN9) are to permit axial displacement of the shaft with respect to the housing, to be taken up in the bearing, space must be provided at the sides of the bearing as shown in fig 7. This prevents damage, such as the cage fouling the face of an adjacent component. The minimum width of this free space should be

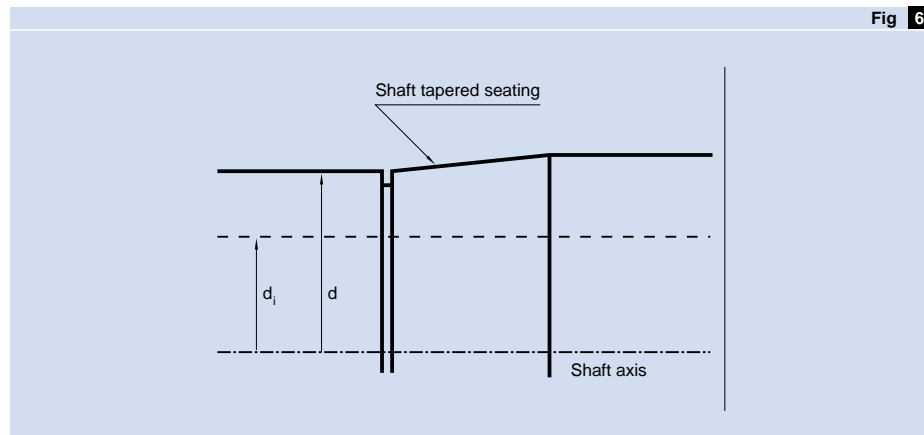
$$C_a = 1,3 s$$

where

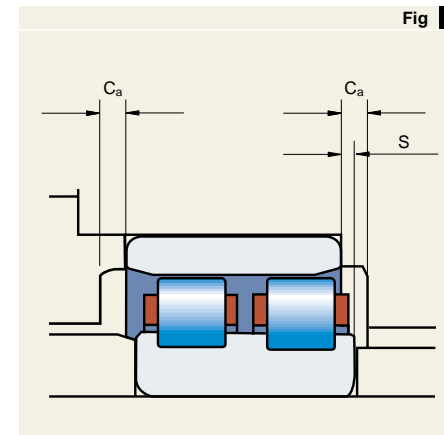
C_a = minimum width of free space, mm;
 s = permissible axial displacement from the normal position of one bearing ring in relation to the other, mm (see product tables).

To facilitate mounting and dismounting of bearings with tapered bore of larger sizes (from bore diameters of approximately 80 mm), it is advisable to use the SKF oil injection method, where oil under high pressure is injected between the bearing bore and its seating. This considerably reduces the force needed to mount or dismount the bearing and practically eliminates the risk of damaging the bearing or the spindle. Where bearings with cylindrical bore are concerned, the oil injection method is used only for dismounting. In order to use the oil injection method it is necessary to provide shafts and/or housings with ducts and distribution grooves. Details of the recommended dimensions and thread for the oil supply connection are provided on request.

Spindle wall thickness



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



Equivalent dynamic bearing load

For cylindrical roller bearings which can only accommodate radial load

$$P = F_r$$

Equivalent static bearing load

For the same reason mentioned before:

$$P_0 = F_r$$

Designation of high-precision cylindrical roller bearings

The complete designation of a high-precision cylindrical roller bearing identifies the series, bore diameter, bore shape, cage type and design, as well as the suffix indicating the tolerance class e.g. NN 3014 KTN/SP. Additional digits may be added to identify bearings incorporating special features, such as: special clearance, special tolerances, etc. Please consult SKF for precise information.

The designation scheme of SKF high-precision cylindrical roller bearings is shown in **Table 7** page 194.

Supplementary designations – specific suffixes

Cylindrical roller bearings are available with information about the exact outside diameter. This information is marked on the box as well as on an inspection sheet inside the box. Bearings supplied with this information and also with the actual clearance specified have the additional suffix VR521, VR522 or VQ496 (also including smaller clearance than standard).

3 Cylindrical roller bearings

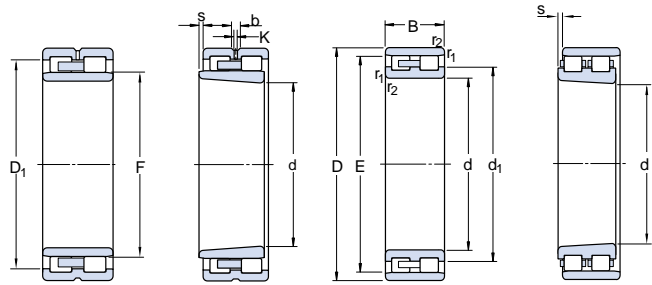
Table 7

	NN 30	20	K	TN9	/	HC5	SP	W33	VR521
Bearing series									
NN 30	Double row cylindrical roller bearing, ISO dimension series 30, flanges of the inner ring								
N 10	Single row cylindrical roller bearing, ISO dimension series 10, flanges of the inner ring								
Bore diameter									
05 (×5)	25 mm bore diameter								
I									
48 (×5)	240 mm bore diameter								
Internal design									
B	Internal design code (NNU 49 series only)								
Bore shape									
-	Cylindrical bore (NNU 49 and NN 30 series only)								
K	Tapered bore 1:12								
Cage design and material									
-	Rolling elements riding, brass								
TNHA	Outer ring land-riding, glass fibre reinforced PEEK								
TN	Rolling elements riding, Polyamide 6,6								
TN9	Rolling elements riding, glass fibre reinforces Polyamide 6,6								
Rolling element material									
-	Chromium steel								
HC5	Silicon nitride								
Precision class									
SP	Special precision (P4 running accuracy)								
UP	Ultra precision (running accuracy better than P4)								
Lubrication									
W33	Groove and lubrication holes in the outer ring (on request for NN 30 series)								
Other									
V numbers	Further specific information about the bearing								

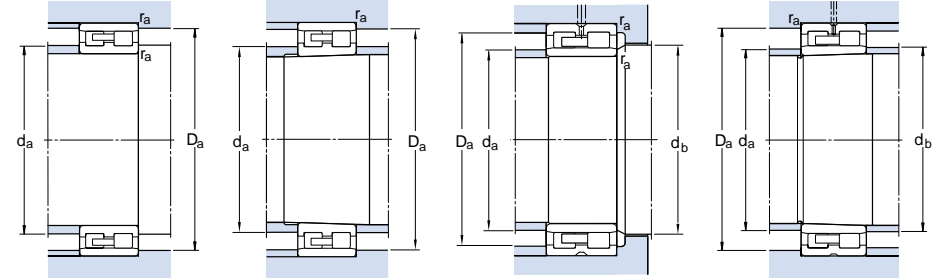
Designations of high-precision cylindrical roller bearings

Product tables

High-precision double row cylindrical roller bearings
d 25 – 80 mm



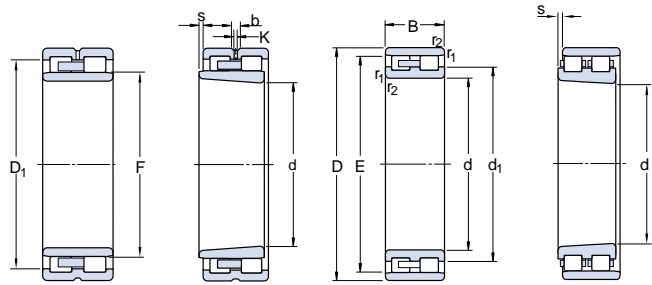
NNU 49 B/W33 NNU 49 BK/W33 NN 30 NN 30 KTN



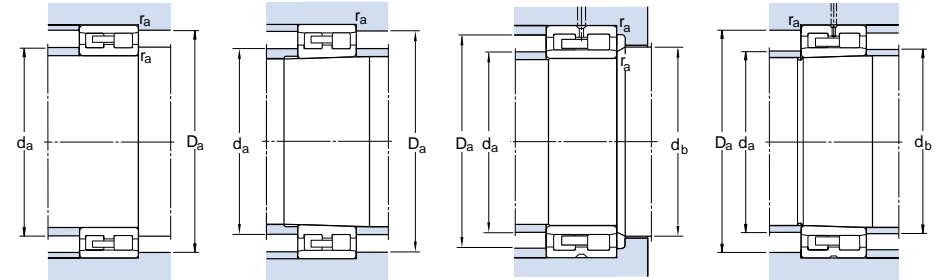
Principal dimensions			Basic load ratings		Fatigue load limit P _u	Speed ratings		Mass	Designation
d	D	B	dynamic C	static C ₀		Lubrication grease	oil spot		
mm			N		N	r/min		kg	–
25	47	16	26 000	30 000	3 100	19 000	22 000	0,12	NN 3005 K
			30 800	37 500					
30	55	19	30 800	37 500	3 900	16 000	18 000	0,19	NN 3006 KTN
			39 100	50 000					
35	62	20	39 100	50 000	5 400	14 000	16 000	0,25	NN 3007 K
			42 900	56 000					
40	68	21	42 900	56 000	6 480	12 000	14 000	0,3	NN 3008 KTN
			50 100	65 500					
45	75	23	50 100	65 500	7 650	11 000	13 000	0,38	NN 3009 KTN
			52 800	73 500					
50	80	23	52 800	73 500	8 500	10 000	12 000	0,42	NN 3010 KTN
			69 300	96 500					
55	90	26	69 300	96 500	11 600	9 500	11 000	0,62	NN 3011 KTN
			73 700	106 000					
60	95	26	73 700	106 000	12 700	9 000	10 000	0,66	NN 3012 KTN
			76 500	116 000					
65	100	26	76 500	116 000	13 700	8 500	9 500	0,71	NN 3013 KTN
			96 800	150 000					
70	110	30	96 800	150 000	17 300	7 500	8 500	1	NN 3014 KTN
			96 800	150 000					
75	115	30	96 800	150 000	17 600	7 000	8 000	1,1	NN 3015 KTN
			119 000	186 000					
80	125	34	119 000	186 000	22 000	6 700	7 500	1,5	NN 3016 KTN

Dimensions							Abutment and fillet dimensions					
d	d ₁ , D ₁ ≈	E, F	b	K	r _{1,2} min	s	d _a min	d _a max	d _b min	D _a max	D _a min	r _a max
mm							mm					
25	33,3	41,3	–	–	0,6	1,4	29	–	–	43	42	0,6
	39,7	48,5	–	–	1	1,8	35	–	–	50	49	1
30	39,7	48,5	–	–	1	1,8	35	–	–	50	49	1
	45,4	55	–	–	1	1,8	40	–	–	57	56	1
35	45,4	55	–	–	1	1,8	40	–	–	57	56	1
	50,6	61	–	–	1	1,3	45	–	–	63	62	1
40	50,6	61	–	–	1	1,3	45	–	–	63	62	1
	56,3	67,5	–	–	1	2	50	–	–	70	69	1
45	56,3	67,5	–	–	1	2	50	–	–	70	69	1
	61,3	72,5	–	–	1	2	55	–	–	75	74	1
50	61,3	72,5	–	–	1	2	55	–	–	75	74	1
	68,2	81	–	–	1,1	2	61,5	–	–	83,5	82	1
55	68,2	81	–	–	1,1	2	61,5	–	–	83,5	82	1
	73,3	86,1	–	–	1,1	2	66,5	–	–	88,5	87	1
60	73,3	86,1	–	–	1,1	2	66,5	–	–	88,5	87	1
	78,2	91	–	–	1,1	2	71,5	–	–	93,5	92	1
65	78,2	91	–	–	1,1	2	71,5	–	–	93,5	92	1
	85,6	100	–	–	1,1	2,5	76,5	–	–	103,5	101	1
70	85,6	100	–	–	1,1	2,5	76,5	–	–	103,5	101	1
	90,6	105	–	–	1,1	2,5	81,5	–	–	108,5	106	1
75	90,6	105	–	–	1,1	2,5	81,5	–	–	108,5	106	1
	97	113	–	–	1,1	3	86,5	–	–	118,5	114	1
80	97	113	–	–	1,1	3	86,5	–	–	118,5	114	1

High-precision double row cylindrical roller bearings
d 85 – 130 mm



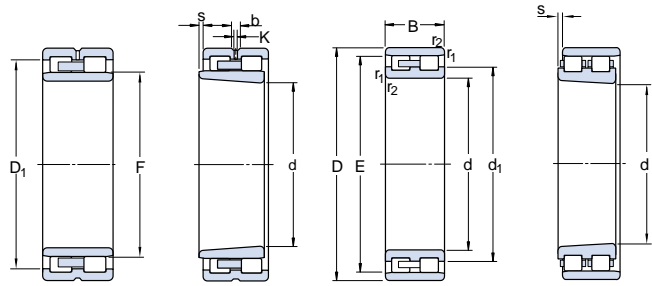
NNU 49 B/W33 NNU 49 BK/W33 NN 30 NN 30 KTN



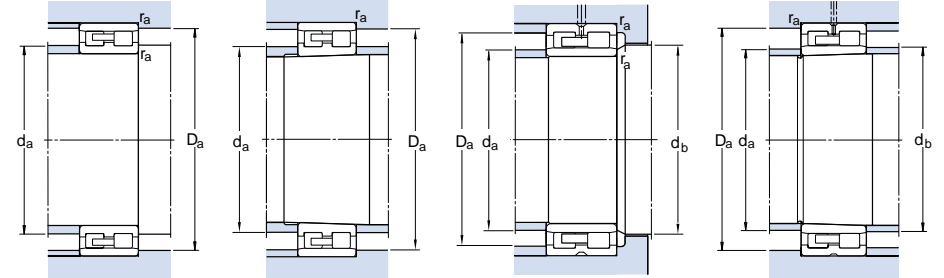
Principal dimensions			Basic load ratings		Fatigue load limit P _u	Speed ratings		Mass	Designation
d	D	B	C	C ₀		Lubrication grease	oil spot		
mm			N		N	r/min		kg	–
85	130	34	125 000	204 000	23 200	6 300	7 000	1,55	NN 3017 TN9
	130	34	125 000	204 000	23 200	6 300	7 000	1,55	NN 3017 KTN9
90	140	37	138 000	216 000	26 000	6 000	6 700	1,95	NN 3018 TN9
	140	37	138 000	216 000	26 000	6 000	6 700	1,95	NN 3018 KTN9
95	145	37	142 000	232 000	27 500	5 600	6 300	2,05	NN 3019 TN9
	145	37	142 000	232 000	27 500	5 600	6 300	2,05	NN 3019 KTN9
100	140	40	128 000	255 000	29 000	5 600	6 300	1,9	NNU 4920 B/W33
	140	40	128 000	255 000	29 000	5 600	6 300	1,8	NNU 4920 BK/W33
	150	37	151 000	250 000	29 000	5 300	6 000	2,1	NN 3020 TN9
	150	37	151 000	250 000	29 000	5 300	6 000	2,1	NN 3020 KTN9
105	145	40	130 000	260 000	29 000	5 300	6 000	2	NNU 4921 B/W33
	145	40	130 000	260 000	29 000	5 300	6 000	1,9	NNU 4921 BK/W33
	160	41	190 000	305 000	36 000	5 000	5 600	2,7	NN 3021 TN9
	160	41	190 000	305 000	36 000	5 000	5 600	2,7	NN 3021 KTN9
110	150	40	132 000	270 000	30 000	5 300	6 000	2,05	NNU 4922 B/W33
	150	40	132 000	270 000	30 000	5 300	6 000	1,95	NNU 4922 BK/W33
	170	45	220 000	360 000	41 500	4 800	5 300	3,4	NN 3022 TN9
	170	45	220 000	360 000	41 500	4 800	5 300	3,4	NN 3022 KTN9
120	165	45	176 000	340 000	37 500	4 800	5 300	2,8	NNU 4924 B/W33
	165	45	176 000	340 000	37 500	4 800	5 300	2,65	NNU 4924 BK/W33
	180	46	229 000	390 000	44 000	4 500	5 000	3,7	NN 3024 TN9
	180	46	229 000	390 000	44 000	4 500	5 000	3,7	NN 3024 KTN9
130	180	50	187 000	390 000	41 500	4 300	4 800	3,85	NNU 4926 B/W33
	180	50	187 000	390 000	41 500	4 300	4 800	3,65	NNU 4926 BK/W33
	200	52	286 000	475 000	53 000	4 000	4 500	5,55	NN 3026 TN9
	200	52	286 000	475 000	53 000	4 000	4 500	5,55	NN 3026 KTN9

Dimensions							Abutment and fillet dimensions					
d	d ₁ , D ₁ ≈	E, F	b	K	r _{1,2} min	s	d _a min	d _a max	d _b min	D _a max	D _a min	r _a max
mm							mm					
85	102	118	–	–	1,1	2,5	91,5	–	–	123,5	119	1
	102	118	–	–	1,1	2,5	91,5	–	–	123,5	119	1
90	109	127	–	–	1,5	2,8	98	–	–	132	129	1,5
	109	127	–	–	1,5	2,8	98	–	–	132	129	1,5
95	114	132	–	–	1,5	2,8	103	–	–	137	134	1,5
	114	132	–	–	1,5	2,8	103	–	–	137	134	1,5
100	126	113	5,5	3	1,1	1,1	1,7	106,5	111	116	–	1
	126	113	5,5	3	1,1	1,1	1,7	106,5	111	116	–	1
	119	137	–	–	1,5	2,8	108	–	–	142	139	1,5
	119	137	–	–	1,5	2,8	108	–	–	142	139	1,5
105	131	118	5,5	3	1,1	1,1	1,7	111,5	116	121	–	1
	131	118	5,5	3	1,1	1,1	1,7	111,5	116	121	–	1
	125	146	–	–	2	1,8	115	–	–	150	148	2
	125	146	–	–	2	1,8	115	–	–	150	148	2
110	136	123	5,5	3	1,1	1,1	1,7	116,5	121	126	–	1
	136	123	5,5	3	1,1	1,1	1,7	116,5	121	126	–	1
	132	155	–	–	2	3,8	120	–	–	160	157	2
	132	155	–	–	2	3,8	120	–	–	160	157	2
120	151	134,5	5,5	3	1,1	1,1	1,7	126,5	133	137	–	1
	151	134,5	5,5	3	1,1	1,1	1,7	126,5	133	137	–	1
	142	165	–	–	2	3,8	130	–	–	170	167	2
	142	165	–	–	2	3,8	130	–	–	170	167	2
130	162	146	5,5	3	1,5	1,5	2,2	138	144	149	–	1,5
	162	146	5,5	3	1,5	1,5	2,2	138	144	149	–	1,5
	156	182	–	–	1,1	3,8	140	–	–	190	183	2
	156	182	–	–	1,1	3,8	140	–	–	190	183	2

High-precision double row cylindrical roller bearings
d 140 – 240 mm



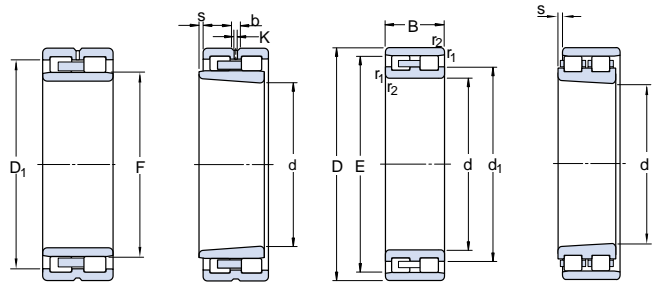
NUU 49 B/W33 NNU 49 BK/W33 NN 30 NN 30 KTN



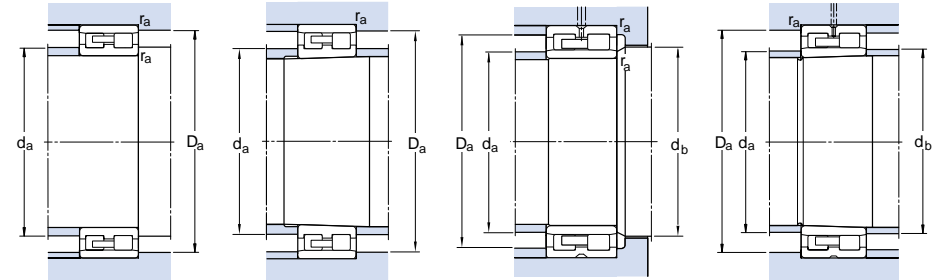
Principal dimensions			Basic load ratings		Fatigue load limit P _u	Speed ratings		Mass	Designation
d	D	B	C	C ₀		Lubrication grease	oil spot		
mm			N		N	r/min		kg	–
140	190	50	190 000	400 000	41 500	4 000	4 500	4,1	NUU 4928 B/W33
	190	50	190 000	400 000	41 500	4 000	4 500	3,9	NUU 4928 BK/W33
	210	53	297 000	520 000	56 000	3 800	4 300	6	NN 3028 K
150	210	60	330 000	655 000	71 000	3 800	4 300	6,25	NUU 4930 B/W33
	210	60	330 000	655 000	71 000	3 800	4 300	6,15	NUU 4930 BK/W33
	225	56	330 000	570 000	62 000	3 600	4 000	7,3	NN 3030 K
160	220	60	330 000	680 000	72 000	3 600	4 000	6,6	NUU 4932 B/W33
	220	60	330 000	680 000	72 000	3 600	4 000	6,3	NUU 4932 BK/W33
	240	60	369 000	655 000	69 500	3 400	3 800	8,8	NN 3032 K
170	230	60	336 000	695 000	73 500	3 400	3 800	6,95	NUU 4934 B/W33
	230	60	336 000	695 000	73 500	3 400	3 800	6,65	NUU 4934 BK/W33
	260	67	457 000	815 000	85 000	3 000	3 400	12	NN 3034 K
180	250	69	402 000	850 000	88 000	3 000	3 400	10,5	NUU 4936 B/W33
	250	69	402 000	850 000	88 000	3 000	3 400	10	NUU 4936 BK/W33
	280	74	561 000	1 000 000	102 000	2 800	3 200	16	NN 3036 K
190	260	69	402 000	880 000	90 000	2 800	3 200	11	NUU 4938 B/W33
	260	69	402 000	880 000	90 000	2 800	3 200	10,5	NUU 4938 BK/W33
	290	75	594 000	1 080 000	108 000	2 600	3 000	17	NN 3038 K
200	280	80	484 000	1 040 000	106 000	2 600	3 000	15	NUU 4940 B/W33
	280	80	484 000	1 040 000	106 000	2 600	3 000	14,5	NUU 4940 BK/W33
	310	82	644 000	1 140 000	118 000	2 400	2 800	21	NN 3040 K
220	300	80	512 000	1 140 000	114 000	2 400	2 800	16,5	NUU 4944 B/W33
	300	80	512 000	1 140 000	114 000	2 400	2 800	16	NUU 4944 BK/W33
	340	90	809 000	1 460 000	143 000	2 200	2 600	27,5	NN 3044 K
240	320	80	528 000	1 220 000	118 000	2 200	2 600	17,5	NUU 4948 B/W33
	320	80	528 000	1 220 000	118 000	2 200	2 600	16,5	NUU 4948 BK/W33
	360	92	842 000	1 560 000	153 000	2 000	2 400	30,5	NN 3048 K

Dimensions							Abutment and fillet dimensions					
d	d ₁ , D ₁ ≈	E, F	b	K	r _{1,2} min	s	d _a min	d _a max	d _b min	D _a max	D _a min	r _a max
mm							mm					
140	172	156	5,5	3	1,5	1,5	2,2	148	154	159	–	1,5
	172	156	5,5	3	1,5	1,5	2,2	148	154	159	–	1,5
	166	192	–	–	2	3,8	150	–	–	200	194	2
150	191	168,5	5,5	3	2	2	2	160	166	172	–	2
	191	168,5	5,5	3	2	2	2	160	166	172	–	2
	178	206	–	–	2,1	4	161	–	–	214	208	2
160	201	178,5	5,5	3	2	2	2	170	176	182	–	2
	201	178,5	5,5	3	2	2	2	170	176	182	–	2
	190	219	–	–	2,1	5	171	–	–	229	221	2
170	211	188,5	5,5	3	2	2	2	180	186	192	–	2
	211	188,5	5,5	3	2	2	2	180	186	192	–	2
	204	236	–	–	2,1	5	181	–	–	249	238	2
180	226	202	8,3	4,5	2	2	2,3	190	199	205	–	2
	226	202	8,3	4,5	2	2	2,3	190	199	205	–	2
	218	255	–	–	2,1	5	191	–	–	269	257	2
190	236	212	8,3	4,5	2	2	1,1	200	209	215	–	2
	236	212	8,3	4,5	2	2	1,1	200	209	215	–	2
	228	265	–	–	2,1	5	201	–	–	279	267	2
200	253	225	11,1	6	2,1	2,1	3,7	211	222	228	–	2
	253	225	11,1	6	2,1	2,1	3,7	211	222	228	–	2
	242	282	–	–	2,1	6,5	211	–	–	299	285	2
220	273	245	11,1	6	2,1	2,1	3,7	231	242	249	–	2
	273	245	11,1	6	2,1	2,1	3,7	231	242	249	–	2
	265	310	–	–	3	7,4	233	–	–	327	313	2,5
240	293	265	11,1	6	2,1	2,1	3,7	251	262	269	–	2
	293	265	1,1	6	2,1	2,1	3,7	251	262	269	–	2
	285	330	–	–	3	7,4	253	–	–	347	333	2,5

High-precision double row cylindrical roller bearings
d 260 – 280 mm



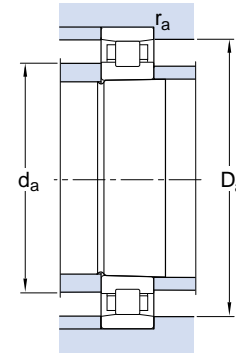
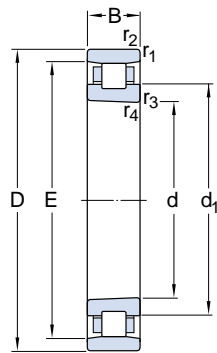
NNU 49 B/W33 NNU 49 BK/W33 NN 30 NN 30 KTN



Principal dimensions			Basic load ratings		Fatigue load limit P_u	Speed ratings		Mass	Designation
d	D	B	dynamic C	static C_0		Lubrication grease	oil spot		
mm			N		N	r/min		kg	–
260	360	100	748 000	1 700 000	163 000	2 000	2 400	30,5	NNU 4952 B/W33
	360	100	748 000	1 700 000	163 000	2 000	2 400	28,5	NNU 4952 BK/W33
	400	104	1 020 000	1 930 000	183 000	1 900	2 200	44	NN 3052 K
280	380	100	765 000	1 800 000	170 000	1 900	2 200	32,5	NNU 4956 B/W33
	380	100	765 000	1 800 000	170 000	1 900	2 200	30,5	NNU 4956 BK/W33
	420	106	1 080 000	2 080 000	196 000	1 800	2 000	47,5	NN 3056 K

Dimensions							Abutment and fillet dimensions					
d	d_1, D_1 ≈	E, F	b	K	$r_{1,2}$ min	s	d_a min	d_a max	d_b min	D_a max	D_a min	r_a max
mm							mm					
260	326	292	13,9	7,5	2,1	2,1	4,5	271	288	296	–	2
	326	292	13,9	7,5	2,1	2,1	4,5	271	288	296	–	2
	312	364	–	–	4	7,4	276	–	–	384	367	3
280	346	312	13,9	7,5	2,1	2,1	4,5	291	308	316	–	2
	346	312	13,9	7,5	2,1	2,1	4,5	291	308	316	–	2
	332	384	–	–	4	12,4	296	–	–	404	387	3

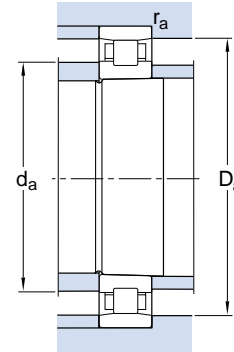
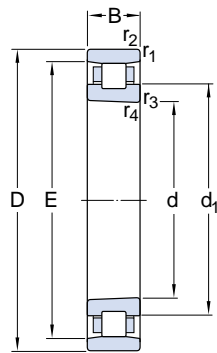
High-precision single row cylindrical roller bearings
d 40 – 95 mm



Principal dimensions			Basic load ratings		Fatigue load limit P_u	Speed ratings		Mass	Designation
d	D	B	C	C_0		Lubrication grease	oil spot		
mm			N		N	r/min		kg	–
40	68	15	25 100	28 000	3 200	15 000	17 000	0,19	N 1008 KTN
	68	15	24 200	26 500	3 050	23 700	32 800	0,19	N 1008 KTNHA
45	75	16	29 200	32 500	3 800	13 000	15 000	0,24	N 1009 KTN
	75	16	28 100	31 000	3 650	21 300	29 600	0,24	N 1009 KTNHA
50	80	16	30 800	36 500	4 250	12 000	14 000	0,26	N 1010 KTN
	80	16	29 700	34 500	4 050	19 600	27 300	0,26	N 1010 KTNHA
55	90	18	40 200	48 000	5 700	11 000	13 000	0,39	N 1011 KTN
	90	18	39 100	46 500	5 500	17 600	24 500	0,39	N 1011 KTNHA
60	95	18	42 900	53 000	6 300	10 000	12 000	0,41	N 1012 KTN
	95	18	41 300	51 000	6 100	16 400	22 800	0,41	N 1012 KTNHA
65	100	18	44 600	58 500	6 800	9 500	11 000	0,44	N 1013 KTN
	100	18	44 000	56 000	6 550	15 500	21 500	0,44	N 1013 KTNHA
70	110	20	57 200	75 000	8 650	9 000	10 000	0,62	N 1014 KTN
	110	20	55 000	72 000	8 300	14 100	19 600	0,62	N 1014 KTNHA
75	115	20	56 100	75 000	8 800	8 500	9 500	0,65	N 1015 KTN
	115	20	55 000	72 000	8 500	13 300	18 600	0,65	N 1015 KTNHA
80	125	22	69 300	93 000	11 000	8 000	9 000	0,89	N 1016 KTN
	125	22	67 100	90 000	10 600	12 400	17 300	0,88	N 1016 KTNHA
85	130	22	73 700	102 000	11 600	7 500	8 500	0,9	N 1017 KTN9
	130	22	70 400	98 000	11 200	11 800	16 500	0,89	N 1017 KTNHA
90	140	24	79 200	108 000	12 900	7 000	8 000	1,2	N 1018 KTN9
	140	24	76 500	104 000	12 500	11 000	15 300	1,19	N 1018 KTNHA
95	145	24	84 200	116 000	14 000	6 700	7 500	1,25	N 1019 KTN9
	145	24	80 900	112 000	13 400	10 500	14 700	1,25	N 1019 KTNHA

Dimensions						Abutment and fillet dimensions				
d	d_1 ≈	E	$r_{1,2}$ min	$r_{3,4}$ min	s	d_a min	d_a max	D_a max	D_a min	r_a max
mm						mm				
40	50,6	61	1	0,6	3	45	59	63	62	1
	50,6	61	1	0,6	3	45	59	63	62	1
45	56,3	67,5	1	0,6	3	50	65	70	69	1
	56,3	67,5	1	0,6	3	50	65	70	69	1
50	61,3	72,5	1	0,6	3	55	70	75	74	1
	61,3	72,5	1	0,6	3	55	70	75	74	1
55	68,2	81	1,1	0,6	3	61,5	79	83,5	82	1
	68,2	81	1,1	0,6	3	61,5	79	83,5	82	1
60	73,3	86,1	1,1	0,6	3	66,5	84	88,5	87	1
	73,3	86,1	1,1	0,6	3	66,5	84	88,5	87	1
65	78,2	91	1,1	0,6	3	71,5	89	93,5	92	1
	78,2	91	1,1	0,6	3	71,5	89	93,5	92	1
70	85,6	100	1,1	0,6	3,5	76,5	98	103,5	101	1
	85,6	100	1,1	0,6	3,5	76,5	98	103,5	101	1
75	90,6	105	1,1	0,6	3,5	81,5	102	108,5	106	1
	90,6	105	1,1	0,6	3,5	81,5	102	108,5	106	1
80	97	113	1,1	0,6	3,5	86,5	110	118,5	114	1
	97	113	1,1	0,6	3,5	86,5	110	118,5	114	1
85	102	118	1,1	0,6	3,5	91,5	115	123,5	119	1
	102	118	1,1	0,6	3,5	91,5	115	123,5	119	1
90	109	127	1,5	1	4	98	124	132	129	1,5
	109	127	1,5	1	4	98	124	132	129	1,5
95	114	132	1,5	1	4	103	129	137	134	1,5
	114	132	1,5	1	4	103	129	137	134	1,5

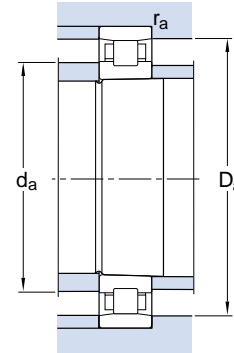
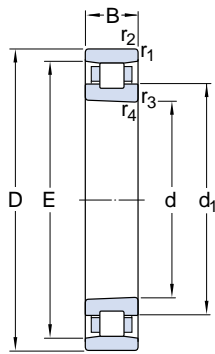
High-precision single row cylindrical roller bearings
d 100 – 120 mm



Principal dimensions			Basic load ratings		Fatigue load limit P_u	Speed ratings		Mass	Designation
d	D	B	dynamic	static		Lubrication grease	oil spot		
mm			C	C_0	N	r/min	kg	–	
100	150	24	88 000	125 000	14 600	6 700	7 500	1,31	N 1020 KTN9
	150	24	85 800	120 000	14 300	10 600	14 700	1,31	N 1020 KTNHA
105	160	26	110 000	153 000	18 000	6 300	7 000	1,65	N 1021 KTN9
	160	26	108 000	146 000	17 300	9 600	13 300	1,64	N 1021 KTNHA
110	170	28	128 000	180 000	20 800	5 600	6 300	2,04	N 1022 KTN9
	170	28	125 000	173 000	20 000	9 000	12 600	2,03	N 1022 KTNHA
120	180	28	134 000	196 000	22 000	5 300	6 000	2,2	N 1024 KTN9
	180	28	130 000	186 000	21 200	8 400	11 700	2,18	N 1024 KTNHA

Dimensions						Abutment and fillet dimensions				
d	d_1	E	$r_{1,2}$	$r_{3,4}$	s	d_a	d_a	D_a	D_a	r_a
mm						min	max	max	min	max
100	119	137	1,5	1	4	108	134	142	139	1,5
	119	137	1,5	1	4	108	134	142	139	1,5
105	125	146	2	1,1	4	114	143	151	148	2
	125	146	2	1,1	4	114	143	151	148	2
110	132	155	2	1,1	4	119	152	161	157	2
	132	155	2	1,1	4	119	152	161	157	2
120	142	165	2	1,1	4	129	162	171	167	2
	142	165	2	1,1	4	129	162	171	167	2

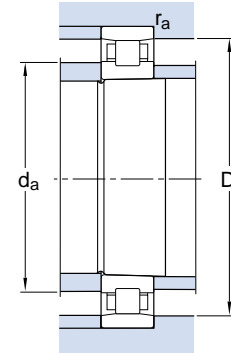
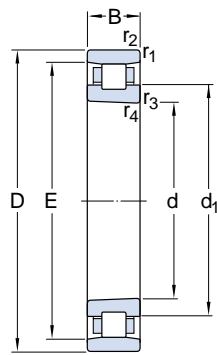
Hybrid high-precision single row cylindrical roller bearings
d 40 – 95 mm



Principal dimensions			Basic load ratings		Fatigue load limit Pu	Speed ratings		Mass	Designation
d	D	B	C	C0		Lubrication grease	oil spot		
mm			N		N	r/min		kg	–
40	68	15	25 100	28 000	3 200	18 100	20 900	0,17	N 1008 KTN/HC5
	68	15	24 200	26 500	3 050	26 400	36 500	0,17	N 1008 KTNHA/HC5
45	75	16	29 200	32 500	3 800	16 300	18 800	0,22	N 1009 KTN/HC5
	75	16	28 100	31 000	3 650	23 800	32 900	0,21	N 1009 KTNHA/HC5
50	80	16	30 800	36 500	4 250	15 100	17 400	0,23	N 1010 KTN/HC5
	80	16	29 700	34 500	4 050	21 900	30 300	0,23	N 1010 KTNHA/HC5
55	90	18	40 200	48 000	5 700	13 500	15 600	0,35	N 1011 KTN/HC5
	90	18	39 100	46 500	5 500	19 700	27 200	0,35	N 1011 KTNHA/HC5
60	95	18	42 900	53 000	6 300	12 600	14 500	0,37	N 1012 KTN/HC5
	95	18	41 300	51 000	6 100	18 400	25 400	0,37	N 1012 KTNHA/HC5
65	100	18	44 600	58 500	6 800	11 800	13 700	0,39	N 1013 KTN/HC5
	100	18	44 000	56 000	6 550	17 300	23 900	0,39	N 1013 KTNHA/HC5
70	110	20	57 200	75 000	8 650	10 800	12 400	0,55	N 1014 KTN/HC5
	110	20	55 000	72 000	8 300	15 700	21 800	0,55	N 1014 KTNHA/HC5
75	115	20	56 100	75 000	8 800	10 200	11 800	0,57	N 1015 KTN/HC5
	115	20	55 000	72 000	8 500	14 900	20 600	0,57	N 1015 KTNHA/HC5
80	125	22	69 300	93 000	11 000	9 500	11 000	0,79	N 1016 KTN/HC5
	125	22	67 100	90 000	10 600	13 900	19 200	0,79	N 1016 KTNHA/HC5
85	130	22	73 700	10 2000	11 600	9 100	10 400	0,80	N 1017 KTN9/HC5
	130	22	70 400	98 000	11 200	13 200	18 300	0,79	N 1017 KTNHA/HC5
90	140	24	79 200	108 000	12 900	8 400	9 700	1,08	N 1018 KTN9/HC5
	140	24	76 500	104 000	12 500	12 300	17 000	1,07	N 1018 KTNHA/HC5
95	145	24	84 200	116 000	14 000	8 100	9 300	1,12	N 1019 KTN9/HC5
	145	24	80 900	112 000	13 400	11 800	16 300	1,12	N 1019 KTNHA/HC5

Dimensions						Abutment and fillet dimensions				
d	d1	E	r1,2	r3,4	s	da	da	Da	Da	ra
mm	≈	mm	min	min	mm	min	max	max	min	max
40	50,6	61	1	0,6	3	45	59	63	62	1
	50,6	61	1	0,6	3	45	59	63	62	1
45	56,3	67,5	1	0,6	3	50	65	70	69	1
	56,3	67,5	1	0,6	3	50	65	70	69	1
50	61,3	72,5	1	0,6	3	55	70	75	74	1
	61,3	72,5	1	0,6	3	55	70	75	74	1
55	68,2	81	1,1	0,6	3	61,5	79	83,5	82	1
	68,2	81	1,1	0,6	3	61,5	79	83,5	82	1
60	73,3	86,1	1,1	0,6	3	66,5	84	88,5	87	1
	73,3	86,1	1,1	0,6	3	66,5	84	88,5	87	1
65	78,2	91	1,1	0,6	3	71,5	89	93,5	92	1
	78,2	91	1,1	0,6	3	71,5	89	93,5	92	1
70	85,6	100	1,1	0,6	3,5	76,5	98	103,5	101	1
	85,6	100	1,1	0,6	3,5	76,5	98	103,5	101	1
75	90,6	105	1,1	0,6	3,5	81,5	102	108,5	106	1
	90,6	105	1,1	0,6	3,5	81,5	102	108,5	106	1
80	97	113	1,1	0,6	3,5	86,5	110	118,5	114	1
	97	113	1,1	0,6	3,5	86,5	110	118,5	114	1
85	102	118	1,1	0,6	3,5	91,5	115	123,5	119	1
	102	118	1,1	0,6	3,5	91,5	115	123,5	119	1
90	109	127	1,5	1	4	98	124	132	129	1,5
	109	127	1,5	1	4	98	124	132	129	1,5
95	114	132	1,5	1	4	103	129	137	134	1,5
	114	132	1,5	1	4	103	129	137	134	1,5

Hybrid high-precision single row cylindrical roller bearings
d 100 – 120 mm



Principal dimensions			Basic load ratings		Fatigue load limit P_u	Speed ratings		Mass	Designation
d	D	B	dynamic	static		Lubrication grease	oil spot		
mm			C	C_0	N	r/min	kg	–	
100	150	24	88 000	125 000	14 600	8 100	9 300	1,17	N 1020 KTN9/HCS
	150	24	85 800	120 000	14 300	11 800	16 400	1,17	N 1020 KTNHA/HCS
105	160	26	110 000	153 000	18 000	7 300	8 400	1,44	N 1021 KTN9/HCS
	160	26	108 000	146 000	17 300	10 700	14 800	1,44	N 1021 KTNHA/HCS
110	170	28	128 000	180 000	20 800	6 900	8 000	1,79	N 1022 KTN9/HCS
	170	28	125 000	173 000	20 000	10 100	14 000	1,78	N 1022 KTNHA/HCS
120	180	28	134 000	196 000	22 000	6 400	7 400	1,92	N 1024 KTN9/HCS
	180	28	130 000	186 000	21 200	9 400	13 000	1,92	N 1024 KTNHA/HCS

Dimensions						Abutment and fillet dimensions				
d	d_1 ≈	E	$r_{1,2}$ min	$r_{3,4}$ min	s	d_a min	d_a max	D_a max	D_a min	r_a max
mm						mm			–	
100	119	137	1,5	1	4	108	134	142	139	1,5
	119	137	1,5	1	4	108	134	142	139	1,5
105	125	146	2	1,1	4	114	143	151	148	2
	125	146	2	1,1	4	114	143	151	148	2
110	132	155	2	1,1	4	119	152	161	157	2
	132	155	2	1,1	4	119	152	161	157	2
120	142	165	2	1,1	4	129	162	171	167	2
	142	165	2	1,1	4	129	162	171	167	2