



**ZKL** GROUP



## **ZKL LARGE-SIZE AND SPECIAL BEARINGS**

NEW TECHNOLOGICAL OPPORTUNITIES





## **ZKL Large-Size and Special Bearings**

### **New Technological Opportunities**





## New Technologies and Production of Large-Size and Special Bearings in ZKL

With a view to meet the requirements of our prominent clients directed to the field of large-size and special bearings ZKL Group has prepared production extension of this assortment up to the D diameter of 1600 mm. Besides of our established production of spherical roller bearings of ZKL Brno assortment we are ready to offer also cylindrical roller bearings, ball bearings and special bearings. Significant users of these bearings can be found in the sphere of power engineering, raw materials mining and heavy engineering in particular.

Production of these bearings is of unit or small-batch character with high demands of professional labor, our aim is to offer shorter delivery terms and more favorable prices as compared with the competition. The periods of delivery of these large-size and special bearings are 12 months after conclusion of binding purchase agreement.

In the second half or year 2009 ZKL Group is prepared to launch production of the said bearings by utilization of new technologies on the following equipments:

1. Multi-functional carousel lathe-turning center
2. Multi-functional carousel grinding center

These new installations will enable

1. Machining and grinding all types of bearings up to the outer diameter of 1600 mm
2. Machining height up to 500 mm
3. Crosswise grinding of spherical bearings outer rings raceways
4. Production of cages for large-size bearings
5. Enhancement of production efficiency

## Double Row Spherical Roller Bearings

Double row spherical roller bearings have two rows of spherical rollers with joint ball-shaped raceway in outer ring. This design enables relative tilting of rings. These bearings can simultaneously accommodate large radial and axial loads in both directions. They are produced either with cylindrical or tapered bore.

### Dimensions

The boundary dimensions of double row spherical roller bearings comply with ISO 15:1998 Standard.

#### Tolerance

The bearings are supplied in normal tolerance class P0 as a standard, without being indicated on them. Requirements of higher tolerance class should be negotiated with the producer. The dimensions tolerances comply with ISO 492:2002 Standard.

### Radial Clearance

Regularly manufactured bearings are of normal radial clearance, it is not indicated in bearing designation. For special types of applications the bearings can be supplied in higher radial clearance C3, C4 and C5 or in reduced clearance C2. All these radial clearances conform to values of ISO 5753:1991 Standard.

### Misalignment

Bearings can be tilted from central position without impairing their correct functions. The following table shows permissible misalignment values, depending on bearing type.

Bearing Type	Permissible Misalignment
239, 230, 231, 222	1°30'
223	2°
232	2°30'
240	2°
241	2°30'

### Calculation of equivalent dynamic load

$$P_r = F_r + Y_1 F_a \text{ pro } F_a/F_r \leq e \text{ [kN]}$$

$$P_r = 0,67F_r + Y_2 F_a \text{ pro } F_a/F_r > e \text{ [kN]}$$

### Calculation of equivalent static load

$$P_{or} = F_r + Y_0 F_a \text{ [kN]}$$

## Double Row Spherical Roller Bearings Specification

Bearing Designation	Boundary Dimensions			Dynamic Load Rating	Static Load Rating	Limiting Speed Frequency for Lubrication by		Fatigue Load Limit
	d	D	B	$C_r$	$C_{or}$	Oil	Grease	$P_u$
	mm			kN		$\text{min}^{-1}$		kN
239/600	600	800	150	3650	9030	400	320	614,25
230/600	600	870	200	5500	12900	380	300	864,75
240/600	600	870	272	7130	16800	320	240	1 126,18
231/600	600	980	300	9020	18200	280	200	1 193,90
241/600	600	980	375	11900	24900	240	180	1 633,42
232/600	600	1090	388	13200	25800	260	190	1 658,63
239/630	630	850	165	4100	10300	360	280	689,05
230/630	630	920	212	6270	13360	340	260	881,46
240/630	630	920	290	7860	18500	300	220	1 220,58
231/630	630	1030	315	10600	21200	260	190	1 370,25

Bearing Designation	Boundary Dimensions			Dynamic Load Rating	Static Load Rating	Limiting Speed Frequency for Lubrication by		Fatigue Load Limit
	d	D	B	C <sub>r</sub>	C <sub>0r</sub>	Oil	Grease	P <sub>u</sub>
	mm			kN		min <sup>-1</sup>		kN
241/630	630	1030	400	13300	28600	220	170	1 848,54
239/670	670	900	170	4490	11200	340	260	736,11
230/670	670	980	230	6820	14690	320	240	951,2
240/670	670	980	308	8920	21500	280	200	1 392,16
231/670	670	1090	336	11100	23100	240	180	1 467,08
241/670	670	1090	412	14400	30600	200	160	1 943,40
232/670	670	1220	438	15700	31100	220	170	1 933,38
239/710	710	950	180	4860	12300	320	240	795
230/710	710	1030	236	7760	17900	300	220	1 140,73
240/710	710	1030	315	9480	23400	260	190	1 491,24
231/710	710	1150	345	12300	26600	240	180	1 661,59
241/710	710	1150	438	15800	33200	190	150	2 073,86
239/750	750	1000	185	5260	13600	300	220	865,21
230/750	750	1090	250	8890	20300	280	200	1 272,17
240/750	750	1090	335	10500	25800	240	180	1 616,85
231/750	750	1220	365	13600	28900	220	170	1 774,41
241/750	750	1220	475	18200	39900	180	140	2 449,79
232/750	750	1360	475	19600	44000	190	150	2 646,45
239/800	800	1060	195	5790	14800	280	200	924,49
230/800	800	1150	258	8620	19600	260	190	1 207,09
240/800	800	1150	345	11400	28900	220	170	1 779,85
231/800	800	1280	375	14900	32600	200	160	1 969,22
241/800	800	1280	475	18300	43400	170	130	2 621,60
239/850	850	1120	200	6090	16000	260	190	982,37
230/850	850	1220	272	9610	22080	240	180	1 335,68
240/850	850	1220	365	12600	32100	240	180	1 941,82
231/850	850	1360	400	16200	35200	200	160	2 087,95
239/900	900	1180	206	6520	17400	180	140	1 051,05
230/900	900	1280	280	10800	26100	240	180	1 554,53
240/900	900	1280	375	13600	34800	220	170	2 072,70
241/900	900	1420	515	22200	52000	190	150	3 039,85
239/950	950	1250	224	7320	19900	220	170	1 182,01
230/950	950	1360	300	12400	29800	140	100	1 744,33
240/950	950	1360	412	15600	42000	220	170	2 458,45
240/1000	1000	1420	412	16100	42800	200	160	2 470,55
231/1000	1000	1580	462	21500	48900	170	130	2 768,97
241/1000	1000	1580	580	24100	53600			3 035,11
239/1060	1060	1400	250	9750	27100			1 556,62
230/1060	1060	1500	325	14200	35400			2 009,22
240/1060	1060	1500	438	18200	48800			2 769,77
240/1120	1120	1580	462	19700	53800			3 005,16
239/1180	1180	1540	272	11200	31900			1 777,93

## Spherical Roller Thrust Bearings

Spherical roller thrust bearings are characterized by high basic dynamic load rating and are capable to accommodate high axial load, concurrently with radial load as well. These bearings are separable. The inner design of the bearing with machined cage centered by means of guiding bush on shaft ring requires solely lubrication by oil.

### Dimensions

The boundary dimensions of spherical roller thrust bearings comply with ISO 104:2002 Standard.

### Tolerance

The bearings are standardly supplied in normal P0 tolerance class, without being shown in the designation.. Requirements of higher tolerance class should be negotiated with the producer. The dimensions tolerances comply with ISO 199:1997 Standard.

### Misalignment

Ball-shaped raceway of housing ring allows under regular operating conditions tilting off the centre position without impairing correct operation of bearing.

The permissible misalignment values are shown in following table.

Bearing Type	Permissible Misalignment
292	2°
293	2°30'
294	3°

### Minimum Axial Load

At higher speed frequency of spherical roller thrust bearings there generates a risk of rolling elements slippage between raceways, as a result of inertial forces action This occurs namely when the axial load  $F_a$  falls below permissible value.

The permissible minimum  $F_a$  load value can be calculated from this formula:

$$F_{a \min} = 1,8 F_r M \left( \frac{n_{\max}}{1000} \right)^2 \quad [\text{kN}]$$

where is:

$F_{a \min}$  – minimum axial load [kN]

$F_r$  – radial bearing load [kN]

$n_{\max}$  – maximum speed frequency [ $\text{min}^{-1}$ ]

$M$  – minimum axial load coefficient

In case the external axial load of bearing is too small or if the operation results in its relieve, permanent axial load must be secured, such as by springs. If radial load is acting at the same time, the prerequisite of  $F_r \leq 0,55F_a$  must be adhered to.

### Calculation of equivalent dynamic load

$$P_a = F_a + 1,2F \quad (F_r \leq 0,55F_a) \quad [\text{kN}]$$

### Calculation of equivalent static load

$$P_{oa} = F_a + 2,7F_r \quad (F_r \leq 0,55F_a) \quad [\text{kN}]$$

The safety coefficient  $s_0$  for spherical roller thrust bearings must be  $s_0 \geq 4$ .

## Spherical Roller Thrust Bearings Specification

Bearing Designation	Boundary Dimensions			Dynamic Load Rating	Static Load Rating	Limiting Speed Frequency for Lubrication by	Fatigue Load Limit
	d	D	B	$C_a$	$C_{oa}$	Oil	Pu
	mm			kN		$\text{min}^{-1}$	kN
292/600	600	800	122	3580	18400	450	1 251,63
293/600	600	900	180	6800	31500	330	2 098,84
294/600	600	1030	258	12800	54900	280	3 567,89
292/630	630	850	132	4250	22500	400	1 505,22
293/630	630	950	190	8300	37900	320	2 486,21
294/630	630	1090	280	14900	62700	260	4 009,63

Bearing Designation	Boundary Dimensions			Dynamic Load Rating	Static Load Rating	Limiting Speed Frequency for Lubrication by	Fatigue Load Limit
	d	D	B	$C_a$	$C_{or}$	Oil	Pu
	mm			kN		min <sup>-1</sup>	kN
292/670	670	900	140	4160	22000	380	1 445,93
293/670	670	1000	200	8980	42000	300	2 709,75
294/670	670	1150	290	15400	67800	240	4 262,88
292/710	710	950	145	5300	27400	360	1 770,98
293/710	710	1060	212	9810	44900	280	2 846,75
294/710	710	1220	308	18000	78100	220	4 824,80
292/750	750	1000	150	6210	31800	340	2 023,07
293/750	750	1120	224	9430	45900	260	2 862,56
294/750	750	1280	315	18900	85600	200	5 208,59
292/800	800	1060	155	6600	34700	320	2 167,56
293/800	800	1180	230	9760	48700	240	2 985,55
294/800	800	1360	335	19900	92600	190	5 530,57
292/850	850	1120	160	6860	37100	300	2 277,87
294/850	850	1440	354	24300	111000	180	6 514,30
294/900	900	1520	372	23100	99900	170	5 766,55
292/950	950	1250	180	8460	47100	260	2 797,62
294/950	950	1600	390	29200	140000	160	7 955,38
293/1000	1000	1460	276	17900	88700	180	5 094,93
292/1060	1060	1400	206	10900	59800	220	3 434,91
292/1180	1180	1520	206	11200	65900	180	3 681,05

## Single Row Deep Groove Ball Bearings

Single row deep groove ball bearings are distinguished by relatively high dynamic load rating. They accommodate radial and axial loads in both directions and are suitable even for higher speed frequencies. They are non-separable.

### Dimensions

The boundary dimensions of single row deep groove ball bearings comply with ISO 15:1998 Standard.

### Tolerance

Single row deep groove ball bearings are supplied in normal tolerance class P0 as a standard, this symbol is not shown in designation. Requirements of higher tolerance class should be negotiated with the producer. The dimensions tolerances comply with ISO 492:2002 Standard.

### Radial Clearance

Regularly manufactured bearings are of normal radial clearance, it is not indicated in bearing designation. For special types of applications the bearings can be supplied in higher radial clearance C3, C4 and C5 or in reduced clearance C2. All these radial clearances values conform to ISO 5753:1991 Standard.

### Misalignment

For single row deep groove ball bearings only a minor relative tilting of bearing rings is permitted, therefore the alignment deviation of seating surfaces is very limited. Misalignment produces additional bearing load and results in substantial shortening of its service life. The values of permissible misalignment under normal operating conditions are given in the following table:

Bearing Type	Light Load ( $F_r < 0,15 C_{or}$ )	Heavy Load ( $F_r \geq 0,15 C_{or}$ )
618, 619, 160, 60	2° až 6°	5° až 10°

### Calculation of equivalent dynamic load

$$P_r = X F_r + Y F_a \text{ [kN]}$$

### Calculation of equivalent static load

$$P_{or} = 0,6 F_r + 0,5 F_a \text{ (} P_{or} \geq F_r \text{) [kN]}$$



## Single Row Deep Groove Ball Bearings Specification

Bearing Designation	Boundary Dimensions			Dynamic Load Rating	Static Load Rating	Limiting Speed Frequency for Lubrication by		Fatigue Load Limit
	d	D	B	C <sub>r</sub>	C <sub>or</sub>	Oil	Grease	Pu
	mm			kN		min <sup>-1</sup>		kN
608/600	600	730	42	281	555	800	670	9,783
618/600	600	730	60	415	780	800	670	13,749
619/600	600	800	90	610	1290	750	630	22,162
60/600	600	870	118	731	1540	700	600	25,82
608/630	630	780	48	370	777	750	630	13,302
618/630	630	780	69	509	990	750	630	16,948
609/630	630	850	71	490	1070	700	600	17,879
619/630	630	850	100	660	1410	700	600	23,56
60/630	630	920	128	823	1810	670	560	29,553
618/670	670	820	69	507	1010	670	560	16,82
609/670	670	900	73	571	1290	670	560	20,928
619/670	670	900	103	721	1560	630	530	25,309
60/670	670	980	136	913	2100	600	500	33,233
618/710	710	870	74	535	1140	630	530	18,436
609/710	710	950	78	612	1320	600	500	20,826
619/710	710	950	106	699	1550	600	500	24,455
60/710	710	1030	140	951	2230	560	480	34,365
618/750	750	920	78	610	1290	600	500	20,292
619/750	750	1000	112	790	1840	560	480	28,274
60/750	750	1090	150	1010	2410	530	450	36,116
608/800	800	980	57	413	1030	530	450	15,693
618/800	800	980	82	639	1390	530	450	21,179
619/800	800	1060	115	901	2190	500	430	32,642
60/800	800	1150	155	1000	2610	480	400	37,994
608/850	850	1030	57	402	1090	500	430	16,16
618/850	850	1030	82	622	1440	500	430	21,349
619/850	850	1120	118	886	2250	480	400	32,587
60/850	850	1220	165	1120	2960	430	360	41,821
618/900	900	1090	85	760	1620	450	380	23,344
619/900	900	1180	122	860	2290	430	360	32,277
60/900	900	1280	170	1180	3250	400	340	44,745
618/950	950	1150	90	741	1780	430	360	24,969
619/950	950	1250	132	1000	2810	400	340	38,511
60/950	950	1360	180	1190	3360	380	320	44,939
608/1000	1000	1220	71	563	1590	400	340	21,693
618/1000	1000	1220	100	722	1860	400	340	25,376
609/1000	1000	1320	103	810	2340	380	320	31,229
619/1000	1000	1320	140	1060	2950	380	320	39,37
60/1000	1000	1420	185	1340	4010	340	280	52,4
618/1060	1060	1280	100	851	2190	360	300	29,102
619/1060	1060	1400	150	1060	2950	340	280	38,234
60/1060	1060	1500	195	1380	4030	320	260	51,201
618/1120	1120	1360	106	831	2250			29,044
619/1120	1120	1460	150	1110	3210			40,624
60/1120	1120	1580	200	1490	4660			57,65
618/1180	1180	1420	106	899	2410			30,382
619/1180	1180	1540	160	1130	3520			43,386
618/1250	1250	1500	112	964	2870			35,181
618/1320	1320	1600	122	1060	3230			38,424



## Single Direction Thrust Ball Bearings

Single direction thrust ball bearings are designed to accommodate axial forces in one direction, while radial forces cannot be accommodated.

### Dimensions

The boundary dimensions of thrust ball bearings comply with ISO 104:2002 Standard.

### Tolerance

The bearings are supplied in normal tolerance class P0 as a standard, this symbol is not shown in designation. Requirements of bearings of higher tolerance class should be negotiated with the producer. The dimensions tolerances comply with ISO 199:1997 Standard.

### Self-Alignment

These bearings require alignment observance of mounting surfaces because eventual misalignment produces higher tension in contacts of balls with raceways. Therefore it is not advisable to use thrust ball bearings in settings where alignment conditions cannot be secured.

### Minimum Axial Load

At higher speed frequencies there generates a risk of balls slippage between rings raceways, as a result of inertial forces action, namely when the axial load  $F_a$  drops below permissible value. The permissible minimum  $F_a$  load value can be calculated from this formula:

$$F_{a \min} = M \left( \frac{n_{\max}}{1000} \right)^2 \text{ [kN]}$$

where is:

$F_{a \min}$  – minimum axial load [kN]

$n_{\max}$  – maximum speed frequency [ $\text{min}^{-1}$ ]

$M$  – minimum axial load coefficient

In case the external axial load of bearing is too small or if during the operation relief of the bearing occurs, permanent axial load must be secured, such as by springs.

### Calculation of equivalent dynamic load

$$P_a = F_a \text{ [kN]}$$

### Calculation of equivalent static load

$$P_{oa} = F_a \text{ [kN]}$$



## Single Direction Thrust Ball Bearings Specification

Bearing Designation	Boundary Dimensions			Dynamic Load Rating	Static Load Rating	Limiting Speed Frequency for Lubrication by		Fatigue Load Limit
	d	D	B	$C_r$	$C_{or}$	Oil	Grease	Pu
	mm			kN		min <sup>-1</sup>		kN
511/600	600	710	85	671	4800	500	380	333,08
511/630	630	750	95	746	5430	450	340	370,96
510/670	670	730	45	297	2430	700	530	165,3
511/670	670	800	105	850	6710	400	300	449,8
510/710	710	780	53	355	2890	600	450	192,95
511/710	710	850	112	909	7700	380	280	507,05
510/750	750	820	53	375	3100	600	450	203,74
511/750	750	900	120	1090	9000	340	240	582,76
510/800	800	870	53	391	3290	560	430	212,26
511/800	800	950	120	1090	9340	340	240	594,2
510/850	850	920	53	379	3640			230,78
511/850	850	1000	120	1110	9610			601,27
510/900	900	980	63	532	4960			308,84
511/900	900	1060	130	1130	10800			664,11
510/950	950	1080	63	555	5230			318,24
511/950	950	1120	135	1340	12400			750,11
510/1000	1000	1090	70	601	5530			333,56
511/1000	1000	1180	140	1390	13800			821,93
510/1060	1060	1150	70	802	5990			355,31
511/1060	1060	1250	150	1500	15300			895,58
511/1120	1120	1320	160	1510	16400			944,33
511/1180	1180	1400	175	1810	20600			1 166,48

## Single Row Cylindrical Roller Bearings

Single row cylindrical roller bearings are noted for their high basic dynamic load rating and are suitable for mountings of high radial load. They are partially separable and are produced in several design versions.

### Design NU

Outer bearing ring has two guiding flanges, inner ring has no guiding flange.

### Design N

Inner bearing ring has two guiding flanges, outer ring has no guiding flange. Both designs permit relative axial displacements of rings in both directions.

### Design NJ

Outer bearing ring has two guiding flanges, inner ring has one guiding flange, which permits to accommodate limited axial forces in one direction.

### Dimensions

The boundary dimensions of single row cylindrical roller bearings comply with ISO 15:1998 Standard.

### Tolerance

The bearings are supplied in normal tolerance class P0 as a standard, this symbol is not shown in designation. Requirements of bearings of higher tolerance class should be negotiated with the producer. The dimensions tolerances comply with ISO 492:2002 Standard.

### Radial Clearance

Regularly manufactured bearings are of normal radial clearance, it is not indicated in bearing designation. For special types of applications the bearings can be supplied in higher radial clearance C3, C4 and C5 or in reduced clearance C2. All these radial clearances conform to ISO 5753:1991 Standard.

### Calculation of equivalent dynamic load

for cylindrical roller bearings of no axial load

$$P_r = F_r \text{ [kN]}$$

### Calculation of equivalent static load

for cylindrical roller bearings of no static load

$$P_{or} = F_r \text{ [kN]}$$

### Axial Load of single row cylindrical roller bearings

Bearings with guiding flanges on both sides can accommodate also axial load of limited values in addition to radial load. Owing to the fact that permissible load of bearings in axial direction depends on many factors which cannot be expressed by a simple calculation, the following relations are of informative character only.

In this case the axial load is not limited by material fatigue but by carrying capacity of lubrication film on contact surface between cylindrical roller face and guiding flange. At regular operating conditions when the temperature difference between the bearing and environment does not exceed 60°C, at mild heat transfer (0.5mW/mm<sup>2</sup> °C<sup>-1</sup>) and at viscosity ratio of 1.5 it is possible to calculate maximum permissible axial load with reasonable accuracy from following equation:

$$F_{a \max} = \frac{0,5 C_{or} \cdot 10^4}{n (d + D)} - 0,05 F_r \text{ [kN]}$$

– for lubrication by oil

$$F_{a \max} = \frac{0,35 C_{or} \cdot 10^4}{n (d + D)} - 0,03 F_r \text{ [kN]}$$

– for lubrication by grease

$F_{a \max}$  – maximum permissible axial load [kN]

$C_{or}$  – basic static load rating [kN]

$F_r$  – radial bearing load [kN]

$n$  – speed frequency [min<sup>-1</sup>]

$d$  – bearing bore diameter [mm]

$D$  – outer bearing diameter [mm]

The values  $F_{a \max}$  calculated according to the above equations are valid under the condition of permanently acting axial force.

More detailed information regarding determination of permissible axial load of cylindrical roller bearings can be obtained at Technical Consulting Services of ZKL-Výzkum a vývoj, a. s.



## Single Row Cylindrical Roller Bearings Specification

Bearing Designation	Boundary Dimensions			Dynamic Load Rating	Static Load Rating	Limiting Speed Frequency for Lubrication by		Fatigue Load Limit
	d	D	B	C <sub>r</sub>	C <sub>or</sub>	Oil	Grease	Pu
	mm			kN		min <sup>-1</sup>		kN
NU18/600	600	730	60	930	2100	800	670	145,06
NU19/600	600	800	90	1990	3990	750	630	271,41
NU10/600	600	870	118	2890	5500	700	600	368,69
NU20/600	600	870	155	4210	8630	600	500	578,51
NU30/600	600	870	200	5560	11650	600	500	780,95
NU28/630	630	780	88	1690	4120	750	630	279,66
N38/630	630	780	112	2260	5990	670	560	406,59
NU19/630	630	850	100	1990	4230	700	600	282,98
NU29/630	630	850	128	3320	7640	700	600	511,1
NU10/630	630	920	128	3400	6420	530	450	423,58
NU20/630	630	920	170	4890	10140	560	480	669,01
NU30/630	630	920	212	6690	14800	530	450	976,47
NJ18/670	670	820	69	1240	3010	670	560	200,96
NU19/670	670	900	103	2550	5090	630	530	334,54
NU10/670	670	980	136	3960	7300	500	430	472,69
NU20/670	670	980	180	5580	11700	500	430	757,59
NU30/670	670	980	230	6850	15000	500	430	971,27
NU18/710	710	870	74	1410	3380	630	530	221,73
N28/710	710	870	95	1990	5290	630	530	347,02
NU29/710	710	950	140	3860	8780	600	500	567,49
NU10/710	710	1030	140	4700	8800	500	430	560,81
NU20/710	710	1030	185	6180	12600	480	400	802,97
NU18/750	750	920	78	1490	3610	600	500	232,91
NU10/750	750	1090	150	4750	9360	430	360	586,58
NU20/750	750	1090	195	7280	14900	430	360	933,76
NJ18/800	800	980	82	1780	4350	530	450	275,33
NU10/800	800	1150	155	5620	11500	400	340	708,24
NU20/800	800	1150	200	7110	15800	400	340	973,06
NU28/850	850	1030	106	2320	6530			406,59
NU19/850	850	1120	118	3480	7560			464,17
N29/850	850	1120	155	4620	11900			730,64
NU18/900	900	1090	85	1990	5120			313,41
NU28/900	900	1090	112	2780	7690			470,72
NU19/900	900	1180	122	4190	9600			579,89
NU29/900	900	1180	165	5890	15100			912,12
NU29/950	950	1250	175	5920	14600			867,2
NU18/1000	1000	1220	100	2630	6800			402,81
NU29/1000	1000	1320	185	7520	18300			1 069,79
N28/1060	1060	1280	128	3800	11400			664,71
NU29/1060	1060	1400	195	7690	18700			1 074,13
NU39/1060	1060	1400	250	9810	26000			1 493,44
N30/1060	1060	1500	325	13100	33900			1 924,08
NJ18/1120	1120	1360	106	3460	9390			538,05
NU30/1120	1120	1580	345	15800	41300			2 306,94
NJ18/1180	1180	1420	106	3290	8430			476,25
NU29/1180	1180	1540	206	9100	22900			1 276,32
N39/1180	1180	1540	272	11000	29200			1 627,45
NU18/1320	1320	1600	122	3860	10100			551,06

## Double Row Cylindrical Roller Bearings

Double row cylindrical roller bearings are characterized by their high basic dynamic load rating and are suitable for mountings of high radial load. They are partially separable and are produced in several design versions.

### Design NN

The inner ring has three guiding flanges, the outer ring has no guiding flange.

### Design NNU

The outer ring has three guiding flanges, the inner ring has no guiding flange.

### Dimensions

The boundary dimensions of double row cylindrical roller bearings comply with ISO 15:1998 Standard.

### Tolerance

The bearings are supplied in normal tolerance class P0 as a standard, this symbol is not shown in designation. Requirements of bearings of higher tolerance class should be negotiated with the producer. The dimensions tolerances comply with ISO 492:2002 Standard.

### Radial Clearance

Regularly manufactured bearings are of normal radial clearance, it is not indicated in bearing designation. For special types of applications the bearings can be supplied in higher radial clearance C3, C4 and C5 or in reduced clearance C2. All these radial clearances conform to ISO 5753:1991 Standard.

### Self-Alignment

Double row cylindrical roller bearings are not suitable for use in applications where permissible relative self-alignment of inner and outer rings is not safeguarded.

### Calculation of equivalent dynamic load

$$P_r = F_r \text{ [kN]}$$

### Calculation of equivalent static load

$$P_{or} = F_r \text{ [kN]}$$

## Double Row Cylindrical Roller Bearings Specification

Bearing Designation	Boundary Dimensions			Dynamic Load Rating	Static Load Rating	Limiting Speed Frequency for Lubrication by	Fatigue Load Limit
	d	D	B	C <sub>r</sub>	C <sub>or</sub>	Oil	P <sub>u</sub>
	mm			kN		min <sup>-1</sup>	kN
NNU49/600	600	800	200	3590	10200	900	457,76
NN30/600	600	870	200	3860	8800	850	389,19
NNU40/600	600	870	272	68100	15400	600	681,09
NNU41/600	600	980	375	9980	21900	480	947,82
NNU49/630	630	850	218	4050	11600	850	511,98
NN30/630	630	920	212	4350	10400	800	452,7
NNU40/630	630	920	290	7820	17800	560	774,81
NNU41/630	630	1030	400	10900	23900	450	1 019,16
NNU49/670	670	900	230	4940	13600	800	589,72

Bearing Designation	Boundary Dimensions			Dynamic Load Rating	Static Load Rating	Limiting Speed Frequency for Lubrication by	Fatigue Load Limit
	d	D	B	$C_r$	$C_{or}$	Oil	Pu
	mm			kN		$\text{min}^{-1}$	kN
NNU40/670	670	980	308	8630	20500	500	875,76
NNU41/670	670	1090	412	12500	26100	430	1 093,61
NNU49/710	710	950	243	5400	15400	700	656,7
NN30/710	710	1030	236	5900	13600	670	571,81
NNU40/710	710	1030	315	9620	22100	480	929,19
NNU41/710	710	1150	438	13200	28400	380	1 170,42
NN48/750	750	920	170	3520	11000	550	468,23
NNU49/750	750	1000	250	5550	16300	670	684,15
NN30/750	750	1090	250	7090	16300	630	673,94
NNU40/750	750	1090	335	10600	24900	430	1 029,51
NNU41/750	750	1220	475	1600	35500	360	1 438,02
NNU49/800	800	1060	258	5930	17600		725,33
NN30/800	800	1150	258	7840	18300		743,56
NNU40/800	800	1150	345	10800	26300		1 068,62
NNU41/800	800	1280	475	16400	36400		1 450,64
NNU49/850	850	1120	272	6000	18100		733,19
NN30/850	850	1220	272	8010	19100		762,29
NNU40/850	850	1220	365	11600	28400		1 133,46
NNU49/900	900	1180	280	6690	21000		836,91
NN30/900	900	1280	280	8240	20100		789,83
NNU40/900	900	1280	375	13200	32800		1 288,88
NNU49/950	950	1250	300	7400	22800		893,48
NN30/950	950	1360	300	9230	23300		899,81
NNU40/950	950	1360	412	13900	35300		1 363,23
NNU49/1000	1000	1320	315	8570	25900		998,92
NN30/1000	1000	1420	308	10300	24900		948,27
NNU40/1000	1000	1420	412	15900	39500		1 504,28
NNU49/1060	1060	1400	335	10800	31100		1 178,57
NN30/1060	1060	1500	325	11200	27800		1 041,00
NNU49/1120	1120	1460	335	10600	32900		1 229,10

## Full Complement Cylindrical Roller Bearings

Full complement cylindrical roller bearings have the largest possible number of rolling elements and therefore they are suitable for extremely high radial loads. However, they cannot operate under similarly high speed frequencies as cylindrical roller bearings with cage. The offer of single row full complement cylindrical roller bearings includes bearings in NCF design.

### NCF Design

Bearings in NCF design have inner ring with two guiding flanges and outer ring with one guiding flange, therefore they accommodate axial loads in one direction only and can be used as single direction axially guiding bearings. Snap ring on the side of outer ring without flange secures the bearing components in assembled condition. Axial clearance of the bearing permits to align certain small shaft displacements against the housing, such as those resulting of shaft dilatation.

### Dimensions

The boundary dimensions of single row full complement cylindrical roller bearings comply with ISO 15:1998 Standard.

### Tolerance

The full complement cylindrical roller bearings are manufactured in normal tolerance class. The tolerance values comply with ISO 492:2002 Standard.

### Radial Clearance

Regularly manufactured full complement cylindrical roller bearings are of normal radial clearance.. Most of dimensional types are optionally available also in higher radial clearance C3. These values are understood for uninstalled beatings and zero load. All the values conform to ISO 5753:1991 Standard.

### Calculation of equivalent dynamic load

$$P_r = F_r \text{ [kN]}$$

applies to axially free bearings



### Calculation of equivalent static load

$$P_{or} = F_r \text{ [kN]}$$

## Full Complement Cylindrical Roller Bearings Specification

Bearing Designation	Boundary Dimensions			Dynamic Load Rating	Static Load Rating	Limiting Speed Frequency for Lubrication by		Fatigue Load Limit
	d	D	B	C <sub>r</sub>	C <sub>or</sub>	Oil	Grease	P <sub>u</sub>
	mm			kN		min <sup>-1</sup>		kN
NCF18/600	600	730	60	1070	2510	320	150	114,39
NCF28/600	600	730	78	1590	4280	320	150	195,06
NCF29/600	600	800	118	3450	7360	300	140	330,31
NCF18/630	630	780	69	1270	2860	300	140	128,08
NCF28/630	630	780	88	1910	4960	300	140	222,12
NCF29/630	630	850	128	3840	8500	280	130	375,16
NCF18/670	670	820	69	1320	3090	280	130	136,11
NCF28/670	670	820	88	1990	5200	280	130	229,05
NCF29/670	670	900	136	3910	8590	260	120	372,48
NCF18/710	710	870	74	1560	3710	260	120	160,57
NCF28/710	710	870	95	2360	6290	260	120	272,23
NCF29/710	710	950	140	4020	9000	240	110	383,78
NCF18/750	750	920	78	1800	4310	240	110	183,46
NCF28/750	750	920	100	2570	6840	240	110	291,15
NCF29/750	750	1000	145	4550	10500	220	100	440,71
NCF18/800	800	980	82	1970	4760	220	100	198,77
NCF28/800	800	980	106	2820	7450	220	100	311,11
NCF29/800	800	1060	150	5020	12100	200	95	498,66
NCF18/850	850	1030	82	2100	5120	200	95	210,33
NCF28/850	850	1030	106	2950	7900	200	95	324,53
NCF29/850	850	1120	155	5390	12800	190	90	518,5
NCF18/900	900	1090	85	2300	5580	190	90	225,35
NCF28/900	900	1090	112	3270	8910	190	90	359,83
NCF29/900	900	1180	165	6060	14700	170	80	585,84
NCF18/950	950	1150	90	2420	6300	170	80	250,35
NCF28/950	950	1150	118	3520	9670	170	80	384,27
NCF29/950	950	1250	175	6750	16100	160	75	630,92
NCF18/1000	1000	1220	100	2990	7450	160	75	291,16
NCF28/1000	1000	1220	128	4210	11500	160	75	449,44
NCF29/1000	1000	1320	185	7520	18500	150	70	713,51



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