



## 12.12 SPECIAL ROLLER BEARINGS

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- Hybrid bearings
- Electrically insulated bearings
- Split bearings
- Other special bearings

### HYBRID BEARINGS

Hybrid bearings have races made of bearing steel and rolling elements made of silicon nitride ( $\text{Si}_3\text{N}_4$ ). Hybrid bearings feature excellent electrical insulation properties that apply mainly in the area of electric motors. Silicon nitride rolling elements prevents passage of current through the bearings which protects also the bearing rings against damage by electric current.

Silicon nitride has also significantly lower density than steel which takes effects mainly at high revolutions by reduction of centrifugal forces which reduces tension of outer ring. This has positive effect to the durability of high rpm bearings. It also reduces inertial forces which takes effect mostly in sudden changes of revolution frequency. Lower inertial forces of rolling elements load cage partitions significantly less, comparing to the standard steel elements.

Silicon nitride has higher elasticity module than bearing steel. This takes effect in contact area by lower contact surface resulting in reduction of rolling and sliding friction. Along with lower weight of ceramic elements and lower centrifugal forces, friction can be reduced at high revolutions. Friction in bearing is closely related to the service temperature of bearing. The lower the friction factor in the bearing, the lower the service temperature. Hybrid bearings are therefore suitable for applications with high revolution frequencies.

Hybrid bearings are capable of operation at low service viscosity since in contact of hybrid rings and silicon nitride elements no abrasion occurs. Hybrid bearings are suitable also in operations where bearings operate at very big dynamic stress, or when bearings are greased only with a very thin lubrication film. Hybrid bearings are used in locations where vibrations act, or where bearings perform oscillation movements only.

Silicon nitride also features lower thermal ductility; bearing is thus less sensitive to temperature changes. Availability of hybrid bearings has to be discussed with the supplier.



## Hybrid ball bearings

Single row hybrid ball bearings are among the most frequently used hybrid bearings which find their application in electric motors. Their construction is very easy and they are able to transfer radial and axial load in both directions.

Hybrid ball bearings are made in dimensions with bore diameter between 10 to 120 mm. Bearings with bigger dimensions can be made upon customer's request. Hybrid bearings for electric motors are made in rows 60, 62 and 63 as uncovered bearings. Standard design is of normal accuracy P0; upon request hybrid bearings can be supplied in accuracy P6 and P5.

Bearing rings are made of the same steel as the one used for all-steel bearings. In standard version bearing are made in dimension stabilisation S0 for operation up to the temperatures of 150 °C. Upon request bearings can be supplied with dimension stabilisation S1 for operation up to the temperatures of 200 °C. In other cases consult the technical and consultancy services of Dunlop BTL



Fig. 12.12.1

## Main dimensions

As standard, hybrid ball bearings are made according to dimensional plan ISO 15.

## Radial clearance

Radial clearances of hybrid ball bearings are the same as clearances of all-steel bearings and comply with ISO 5753. For use in electric and traction motors, bearings with radial clearance C3 are used most of the time.

## Misalignment

Hybrid ball bearings do not suit compensation of misalignment. Depending on radial clearance, bearing dimensions and forces acting on bearing, admissible tilting of bearing ranges between 2 to 10 angular minutes. Tilting of inner race against outer ring causes excessive noise and reduces service life of bearing.

## Cages

Hybrid ball bearings are mostly made with metal cages. Some applications utilise polyamide cages that only suit in temperatures to 120 °C. Standard cages are in the same design as for common ball bearings, are stated in chapter 7.4:



- Two-piece riveted steel plate cage guided by balls (is not designated)
- Two-piece riveted massive brass cage guided on the external race (MA)
- Single-piece polyamide cage reinforced with fibre glasses guided by balls (TNG).

## Minimum load

Hybrid ball bearings are more resistant to damage of raceways caused by slippage in sufficient loading. Comparing to common steel bearings, they can provide reliable run with lower minimum load. Therefore these bearings also suit locations where very small or variable load acts on bearings.

## Axial load rating

Bearing must not be exposed to purely axial load exceeding 50%  $C_{0r}$ . Small bearings and light rows must not be exposed to axial load exceeding 25%  $C_{0r}$ . If the above stated values are exceeded, the service life of bearing reduces dramatically.

## Equivalent dynamic and static load of bearing

Equivalent dynamic and static load of bearing is calculated same as for common all-steel ball bearing, see chapter Single row ball bearings.

## Designation of hybrid ball bearings

Hybrid ball bearings have the same designation system as standard all-steel ball bearings. Use of ceramics on bearing components is characterised with an additional "C" character before the bearing designation, e.g.: C 6213MA.

## Hybrid cylindrical roller bearings

Hybrid cylindrical roller bearings are located where bearings are loaded with big radial load and where hybrid ball bearings can no longer be used due to their lower dynamic load capacity. Hybrid cylindrical roller bearings are made in standard dimensions complying with ISO 15. Hybrid cylindrical roller bearings are made in designs with two-piece massive brass cage guided on outer ring (MA), another cage design has to be consulted with the supplier.

Hybrid cylindrical roller bearings have the same designation system as standard all-steel roller bearings with the only difference of having the „C" character before the designation of the bearing, e.g.: C NU312MA. Availability and details on these bearings are available at the technical and consultancy services of Dunlop BTL.



## ELECTRICALLY INSULATED BEARINGS

Bearings in electric motors and generators, together with related equipment might get damages due to passage of electric current that participates in damaging the raceways of rings and rolling elements, causing fast degradation of the lubricant used.

Bearings are supplied with insulating ceramic spray application ( $Al_2O_3$ ) on the outer ring surface; the aluminium oxide thickness is 0.15 mm. Bearings insulated in the above described manner are capable of resisting to DC voltage up to 1000 V. The spray application is coated thermally on the outer surface of the outer ring, and complies with the requirements for surface hardness and adhesion to the surface the spray is applied on. These bearings have an additional designation TM01, e.g.: NU1012M TM01. In the designation means

TM . . . . . bearing with thermal insulation spray application (always in combination with a pair of characters for the layer characteristics)

0 . . . . .  $Al_2O_3$  spray application with minimum resistance of 50 M $\Omega$  at DC voltage of 1000 V

1 . . . . . ceramic spray application on the outer ring surface (2 on inner race, 3 on both races).

Mostly used are single row ball bearings and single row cylindrical roller bearings. Bearings insulated with aluminium oxide have the same dimensions and design as standard bearings. Dimensions of ball and cylindrical roller bearings with  $Al_2O_3$  layer correspond with the ISO 15 dimensional plan. The availability of electrically insulated bearings has to be consulted with the supplier.

Standard design is that of normal accuracy P0; upon request the bearings can be supplied even in higher accuracy P6 and P5. The bearings are made in normal radial clearance or, upon request, in bigger radial clearances C3 and C4. Radial clearances are stated in tables 7.17a for single row ball bearings and 7.19 for single row cylindrical roller bearings.

Electrically insulated bearings are made mostly with a two-piece massive brass cage guided on rolling elements, or with a two-piece steel plate cage guided on rolling elements. In some cases, especially in smaller bearings, a single-piece plastic cage reinforced with fibre glass is used.

Other properties of electrically insulated bearings are identical to those of common bearings; detailed information on these bearings is available in individual chapters on single row ball bearings and single row cylindrical roller bearings.

The table section states the most common electrically insulated bearings. Please consult delivery of bearings of different dimensions and types with the supplier.



Fig. 12.12.2



## SPECIAL DUNLOP BTL BEARINGS

Besides standardised bearings in basic and different designs stated in this catalogue, Dunlop BTL supplies also special roller bearings. They usually feature non-standardised dimensions and cannot be included in standardised series. Production of special bearings often utilises different materials. These bearings are purposely designed for applications in machines and equipment where the construction does not allow use of standardised bearings. The dimensions and basic parameters of the bearings are stated in the table section.

## OTHER SPECIAL BEARINGS

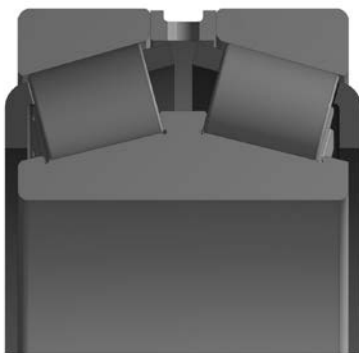
Dunlop BTL manufactures additional type and dimensional series of bearings, parameters of which are not listed in this catalogue. More detailed information about special Dunlop BTL bearings is available in professional company publications. Use of special roller bearings is mainly recommended in more demanding cases of location, and supplies of bearings, their locations and assembly should be consulted with the supplier. Further information on special roller bearings is available through the Dunlop BTL sales team.



### Multi row roller bearings

They are used to capture extremely big radial forces with limited build-up dimensions, mainly in smelting industry for location of rolling mill rollers. Rings of these bearings are provided with lubrication holes to ensure supply of lubricant in all roller rows.

Fig. 12.12.3



### Single row and double row tapered roller bearings

They are used mainly in automotive industry and in heavy machinery.

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## Double and four row tapered roller bearings

They are used to locate rolling mill rollers and rollers of other plants in steel rolling mills. They are manufactured with axial clearance the size of which is determined upon the service conditions.

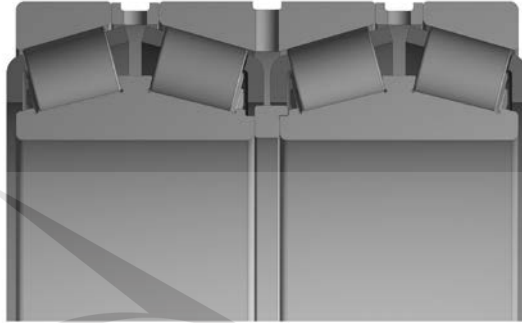


Fig. 12.12.5

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## Crossed roller bearings

In standard design, crossed roller bearings are compact two ring bearings with cross arrangement of rollers in raceway between the inner and outer ring. In majority of cases, rollers are separated with plastic separators or alternatively with a massive or segment cage. The contact angle of raceway is usually  $45^\circ$ . The bearings are supplied with clearance or prestress, depending on the use. Bearing rings are provided with bores for fixing bolts. Inner space is protected with rubber sealing to prevent excessive leak of grease from the bearing and penetration of impurities inside the bearing.

It is manufactured with outer diameter between 300 to 1 600 mm, and with inner or outer gearing or – more precisely – without gearing for location of building and earth-moving machinery, robots and manipulators, machine tools, mining combine harvesters, stamp plates, wind power plants, rotary furnaces and mill mixers.



Fig. 12.12.6



### Large size ball bearings with four-point contact and double row ball bearings with angular contact

Bearings suitable for continuously rotating plants and also for machines with cyclic operation character of medium sizes, such as excavators and cranes. To ensure higher revolution frequency, bearings with massive or segment cage are made. They have a relatively low friction torque. The rigidity of location with the use of ball bearings is lower than that of bearings with crossed rollers. Usually they have a contact angle of  $45^\circ$ . They are manufactured with outer diameter ranging between 300 and 1600 with inner or outer gearing or - more precisely - without gearing.



Fig. 12.12.7

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### Double direction cylindrical roller and tapered thrust bearings

They are used to capture big radial forces in rolling mill rollers' locations, and also where high rigidity in axial direction is required, mainly in locations of carousel desks.

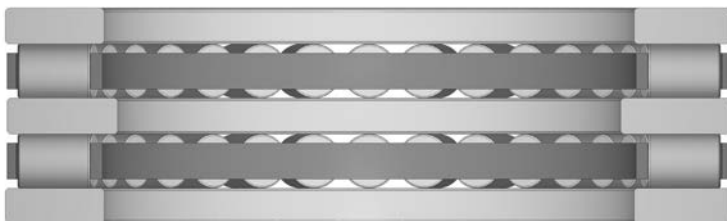
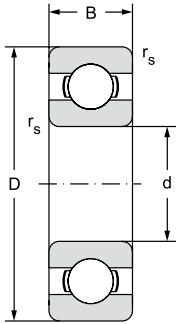


Fig. 12.12.8



Hybrid ball bearings d = 10 to 120 mm

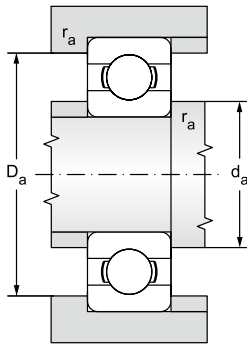
d = 10 to 55 mm



12.12.1

Main dimensions				Basic load rating		Fatigue load limit
d	D	B	r <sub>s</sub>	dynamic C <sub>r</sub>	static C <sub>or</sub>	P <sub>u</sub>
mm				kN		kN
10	26	8,0	0,3	4,56	1,96	0,089
	30	9,0	0,6	6,05	2,51	0,114
12	28	8,0	0,3	5,09	2,36	0,107
	32	10,0	0,6	6,91	3,10	0,141
15	32	9,0	0,3	5,59	2,87	0,130
	35	11,0	0,6	7,72	3,75	0,170
17	35	10,0	0,3	6,00	3,27	0,149
	40	12,0	0,6	9,53	4,73	0,215
20	42	12,0	0,6	9,37	4,97	0,226
	47	14,0	1,0	12,77	6,55	0,298
25	47	12,0	0,6	10,07	5,81	0,264
	52	15,0	1,0	14,03	7,94	0,361
30	55	13,0	1,0	13,24	8,25	0,375
	62	16,0	1,0	19,44	11,19	0,508
35	62	14,0	1,0	15,96	10,33	0,469
	72	17,0	1,1	25,66	15,23	0,692
40	68	15,0	1,0	16,82	11,49	0,522
	80	18,0	1,1	32,63	19,89	0,904
	90	23,0	1,5	40,76	24,17	1,099
45	75	16,0	1,0	21,10	15,30	0,695
	85	19,0	1,1	32,68	20,33	0,924
	100	25,0	1,5	52,80	31,72	1,442
50	80	16,0	1,0	21,72	16,65	0,757
	90	20,0	1,1	35,07	23,23	1,056
	110	27,0	2,0	61,75	37,75	1,716
55	90	18,0	1,1	28,22	21,32	0,969
	100	21,0	1,5	43,35	29,40	1,336
	120	29,0	2,0	71,00	44,70	2,032



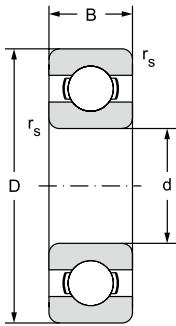


Limiting speed for lubrication with		Bearing designation	Abutment and fillet dimensions			Weight
grease	oil		d <sub>a</sub> min	D <sub>a</sub> max	r <sub>a</sub> max	
min <sup>-1</sup>			mm			kg
28000	33000	<b>C 6000</b>	12,0	24,0	0,3	0,018
25000	30000	<b>C 6200</b>	14,0	26,0	0,6	0,031
25000	30000	<b>C 6001</b>	14,0	26,0	0,3	0,022
22000	27000	<b>C 6201</b>	16,0	28,0	0,6	0,037
21000	25000	<b>C 6002</b>	17,0	30,0	0,3	0,030
20000	24000	<b>C 6202</b>	19,0	31,0	0,6	0,044
20000	24000	<b>C 6003</b>	19,0	33,0	0,3	0,040
18000	21000	<b>C 6203</b>	21,0	36,0	0,6	0,073
17000	20000	<b>C 6004</b>	24,0	38,0	0,6	0,070
15000	18000	<b>C 6204</b>	25,0	42,0	1,0	0,11
14000	17000	<b>C 6005</b>	28,0	43,0	0,6	0,082
12000	15000	<b>C 6205</b>	30,0	47,0	1,0	0,13
12000	14000	<b>C 6006</b>	34,0	50,0	1,0	0,12
11000	13000	<b>C 6206</b>	35,0	57,0	1,0	0,20
10600	12600	<b>C 6007</b>	39,5	57,0	1,0	0,15
9400	11000	<b>C 6207</b>	42,0	65,0	1,0	0,28
9400	11000	<b>C 6008</b>	44,0	63,0	1,0	0,19
8400	10000	<b>C 6208</b>	47,0	73,0	1,0	0,35
7900	9400	<b>C 6308</b>	47,0	81,0	1,5	0,63
8400	10000	<b>C 6009</b>	49,0	70,0	1,0	0,24
7900	9400	<b>C 6209</b>	52,0	78,0	1,0	0,40
7100	8400	<b>C 6309</b>	52,0	91,0	1,5	0,83
7900	9400	<b>C 6010</b>	54,0	75,0	1,0	0,26
7100	8400	<b>C 6210</b>	57,0	83,0	1,0	0,46
6300	7500	<b>C 6310</b>	60,0	100,0	2,0	1,06
7100	8400	<b>C 6011</b>	60,0	84,0	1,0	0,38
6700	7900	<b>C 6211</b>	62,0	91,0	1,5	0,60
5600	6700	<b>C 6311</b>	65,0	110,0	2,0	1,38



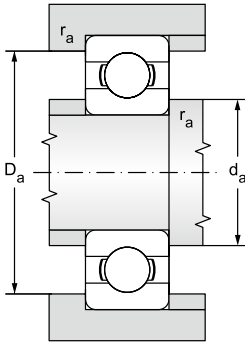
Hybrid ball bearings

d = 60 to 120 mm



12.12.1

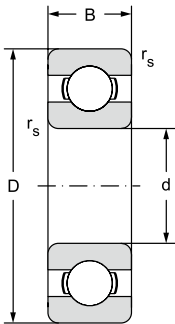
d	Main dimensions			Basic load rating		Fatigue load limit
	D	B	r <sub>s</sub>	dynamic C <sub>r</sub>	static C <sub>or</sub>	P <sub>u</sub>
mm				kN		kN
60	110	22,0	1,5	52,85	35,79	1,627
	130	31,0	2,1	81,50	52,10	2,368
65	120	23,0	1,5	57,21	40,01	1,819
	140	33,0	2,1	92,60	59,60	2,676
70	125	24,0	1,5	62,00	43,80	1,991
	150	35,0	2,1	104,00	63,10	2,735
75	130	25,0	1,5	66,18	49,31	2,214
	160	37,0	2,1	114,00	76,40	3,204
80	140	26,0	2,0	72,20	53,10	2,301
	170	37,0	2,1	122,85	86,23	3,506
85	150	28,0	2,0	83,30	63,68	2,670
	180	41,0	3,0	132,51	96,07	3,794
90	160	30,0	2,0	96,20	70,80	2,878
	190	43,0	3,0	144,00	108,00	4,149
95	170	32,0	2,1	108,00	81,00	3,199
	200	45,0	3,0	152,44	117,37	4,393
100	180	34,0	2,1	123,00	92,60	3,557
	215	47,0	3,0	174,00	141,00	5,107
105	190	36,0	2,1	132,93	104,83	3,924
110	200	38,0	2,1	144,00	117,00	4,272
120	215	40,0	2,1	144,00	117,00	4,109



Limiting speed for lubrication with		Bearing designation	Abutment and fillet dimensions			Weight
grease	oil		d <sub>a</sub> min	D <sub>a</sub> max	r <sub>a</sub> max	
min <sup>-1</sup>			mm			kg
6000	7100	<b>C 6212MA</b>	67,0	101,0	1,5	0,77
5300	6300	<b>C 6312MA</b>	72,0	118,0	2,0	1,72
5300	6300	<b>C 6213MA</b>	72,0	111,0	1,5	1,00
5000	6000	<b>C 6313MA</b>	76,0	128,0	2,0	2,10
5300	6300	<b>C 6214MA</b>	77,0	116,0	1,5	1,07
4700	5600	<b>C 6314MA</b>	81,0	138,0	2,0	2,54
5000	6000	<b>C 6215MA</b>	82,0	122,0	1,5	1,18
4200	5000	<b>C 6315MA</b>	86,0	148,0	2,0	3,06
4700	5600	<b>C 6216MA</b>	90,0	130,0	2,0	1,40
4000	4700	<b>C 6316MA</b>	91,0	158,0	2,0	3,63
4200	5000	<b>C 6217MA</b>	95,0	140,0	2,0	1,80
3800	4500	<b>C 6317MA</b>	98,0	166,0	2,5	4,20
4000	4700	<b>C 6218MA</b>	100,0	150,0	2,0	2,16
3500	4200	<b>C 6318MA</b>	103,0	176,0	2,5	4,95
3800	4500	<b>C 6219MA</b>	107,0	158,0	2,0	2,60
3300	4000	<b>C 6319MA</b>	109,0	186,0	2,5	5,72
3500	4200	<b>C 6220MA</b>	112,0	169,0	2,0	3,13
3200	3800	<b>C 6320MA</b>	113,0	201,0	2,5	7,07
3300	4000	<b>C 6221MA</b>	117,0	178,0	2,0	3,74
3200	3800	<b>C 6222MA</b>	122,0	188,0	2,0	4,37
3000	3500	<b>C 6224MA</b>	132,0	203,0	2,0	5,15

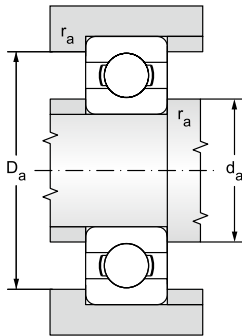


Electrically insulated ball bearings d = 70 to 150 mm



12.12.2

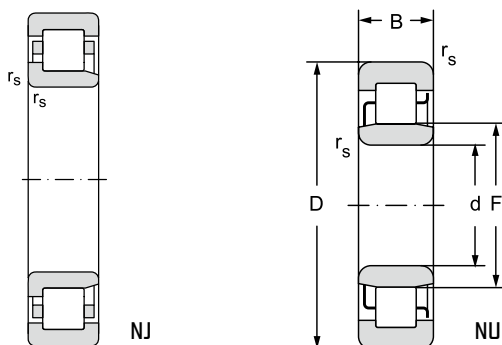
Main dimensions				Basic load rating		Fatigue load limit
d	D	B	r <sub>s</sub>	dynamic C <sub>r</sub>	static C <sub>or</sub>	P <sub>u</sub>
mm				kN		kN
70	125	24,0	1,5	62,00	43,80	1,991
	150	35,0	2,1	104,00	63,10	2,735
75	130	25,0	1,5	66,18	49,31	2,214
	160	37,0	2,1	114,00	76,40	3,204
80	140	26,0	2,0	72,20	53,10	2,301
	170	37,0	2,1	122,85	86,23	3,506
85	150	28,0	2,0	83,30	63,68	2,670
	180	41,0	3,0	132,51	96,07	3,794
90	160	30,0	2,0	96,20	70,80	2,878
	190	43,0	3,0	144,00	108,00	4,149
95	170	32,0	2,1	108,00	81,00	3,199
	200	45,0	3,0	152,44	117,37	4,393
100	180	34,0	2,1	123,00	92,60	3,557
	215	47,0	3,0	174,00	141,00	5,107
110	200	38,0	2,1	144,00	117,00	4,272
	240	50,0	3,0	203,00	180,00	6,185
120	215	40,0	2,1	144,00	117,00	4,109
	260	55,0	3,0	208,00	186,00	6,134
130	230	40,0	3,0	156,00	132,00	4,472
	280	58,0	4,0	229,00	216,00	6,857
140	250	42,0	3,0	166,00	150,00	4,883
	300	62,0	4,0	251,00	245,00	7,508
150	270	45,0	3,0	190,00	181,00	5,677
	320	65,0	4,0	276,00	285,00	8,451



Limiting speed for lubrication with		Bearing designation	Abutment and fillet dimensions			Weight
grease	olejem		d <sub>a</sub> min	D <sub>a</sub> max	r <sub>a</sub> max	
min <sup>-1</sup>			mm			kg
5300	6300	<b>6214M TM01</b>	77,0	116,0	1,5	1,07
4700	5600	<b>6314M TM01</b>	81,0	138,0	2,0	2,54
5000	6000	<b>6215M TM01</b>	82,0	122,0	1,5	1,18
4200	5000	<b>6315M TM01</b>	86,0	148,0	2,0	3,06
4700	5600	<b>6216M TM01</b>	90,0	130,0	2,0	1,40
4000	4700	<b>6316M TM01</b>	91,0	158,0	2,0	3,63
4200	5000	<b>6217M TM01</b>	95,0	140,0	2,0	1,80
3800	4500	<b>6317M TM01</b>	98,0	166,0	2,5	4,20
4000	4700	<b>6218M TM01</b>	100,0	150,0	2,0	2,16
3500	4200	<b>6318M TM01</b>	103,0	176,0	2,5	4,95
3800	4500	<b>6219M TM01</b>	107,0	158,0	2,0	2,60
3300	4000	<b>6319M TM01</b>	109,0	186,0	2,5	5,72
3500	4200	<b>6220M TM01</b>	112,0	169,0	2,0	3,13
3200	3800	<b>6320M TM01</b>	113,0	201,0	2,5	7,07
3200	3800	<b>6222M TM01</b>	122,0	188,0	2,0	4,37
2600	3200	<b>6322M TM01</b>	123,0	227,0	2,5	9,58
3000	3500	<b>6224M TM01</b>	132,0	203,0	2,0	5,15
2500	3000	<b>6324M TM01</b>	134,0	246,0	2,5	12,5
2600	3100	<b>6226M TM01</b>	144,0	216,0	2,5	5,75
2350	2800	<b>6326M TM01</b>	147,0	263,0	3,0	15,2
2500	3000	<b>6228M TM01</b>	154,0	236,0	2,5	7,56
2350	2800	<b>6328M TM01</b>	157,0	283,0	3,0	21,8
2200	2700	<b>6230M TM01</b>	164,0	256,0	2,5	9,85
2000	2400	<b>6330M TM01</b>	167,0	303,0	3,0	24,0

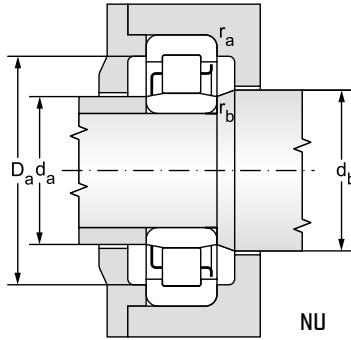
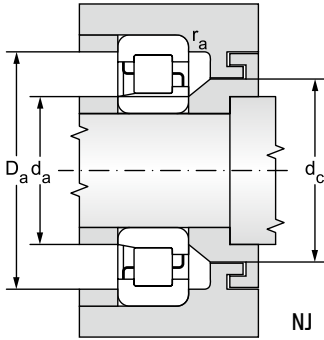


Electrically insulated cylindrical roller bearings d = 70 to 150 mm d = 70 to 100 mm



12.12.3

		Main dimensions					Bearing designation	Basic load rating	
d	D	B	r <sub>s</sub> min	r <sub>1s</sub> min	F	s <sub>1)</sub>		dynamic C <sub>r</sub>	static C <sub>0r</sub>
mm							kN		
70	125	24,00	1,5	1,5	83,500	1,6	<b>NU214EM TM01</b>	119,0	137,0
	125	24,00	1,5	1,5	83,500	1,6	<b>NJ214EM TM01</b>	119,0	137,0
	125	31,00	1,5	1,5	83,500	1,6	<b>NU2214EM TM01</b>	156,0	194,0
	125	31,00	1,5	1,5	83,500	1,6	<b>NJ2214EM TM01</b>	156,0	194,0
	150	35,00	2,1	2,1	89,000	1,5	<b>NU314EM TM01</b>	205,0	222,0
	150	35,00	2,1	2,1	89,000	1,5	<b>NJ314EM TM01</b>	205,0	222,0
75	130	25,00	1,5	1,5	88,500	1,6	<b>NU215EM TM01</b>	130,0	156,0
	130	25,00	1,5	1,5	88,500	1,6	<b>NJ215EM TM01</b>	130,0	156,0
	130	31,00	1,5	1,5	88,500	2,1	<b>NU2215EM TM01</b>	162,0	207,0
	130	31,00	1,5	1,5	88,500	2,1	<b>NJ2215EM TM01</b>	162,0	207,0
	160	37,00	2,1	2,1	95,000	1,5	<b>NU315EM TM01</b>	240,0	263,0
	160	37,00	2,1	2,1	95,000	1,5	<b>NJ315EM TM01</b>	240,0	263,0
80	140	26,00	2,0	2,0	95,300	2,0	<b>NU216EM TM01</b>	139,0	167,0
	140	26,00	2,0	2,0	95,300	2,0	<b>NJ216EM TM01</b>	139,0	167,0
	170	39,00	2,1	2,1	101,000	1,5	<b>NU316EM TM01</b>	256,0	282,0
	170	39,00	2,1	2,1	101,000	1,5	<b>NJ316EM TM01</b>	256,0	282,0
85	150	28,00	2,0	2,0	100,500	2,0	<b>NU217EM TM01</b>	167,0	199,0
	150	28,00	2,0	2,0	100,500	2,0	<b>NJ217EM TM01</b>	167,0	199,0
	180	41,00	3,0	3,0	108,000	2,0	<b>NU317EM TM01</b>	291,0	330,0
	180	41,00	3,0	3,0	108,000	2,0	<b>NJ317EM TM01</b>	291,0	330,0
90	160	30,00	2,0	2,0	107,000	2,0	<b>NU218EM TM01</b>	182,0	217,0
	160	30,00	2,0	2,0	107,000	2,0	<b>NJ218EM TM01</b>	182,0	217,0
	190	43,00	3,0	3,0	113,500	2,0	<b>NU318EM TM01</b>	315,0	355,0
	190	43,00	3,0	3,0	113,500	2,0	<b>NJ318EM TM01</b>	315,0	355,0
95	170	32,00	2,1	2,1	112,500	2,0	<b>NU219EM TM01</b>	220,0	265,0
	170	32,00	2,1	2,1	112,500	2,0	<b>NJ219EM TM01</b>	220,0	265,0
	200	45,00	3,0	3,0	121,500	1,9	<b>NU319EM TM01</b>	335,0	385,0
	200	45,00	3,0	3,0	121,500	1,9	<b>NJ319EM TM01</b>	335,0	385,0
100	180	34,00	2,1	2,1	119,000	2,0	<b>NU220EM TM01</b>	249,0	305,0
	180	34,00	2,1	2,1	119,000	2,0	<b>NJ220EM TM01</b>	249,0	305,0
	215	47,00	3,0	3,0	127,500	2,0	<b>NU320EM TM01</b>	380,0	425,0
	215	47,00	3,0	3,0	127,500	2,0	<b>NJ320EM TM01</b>	380,0	425,0



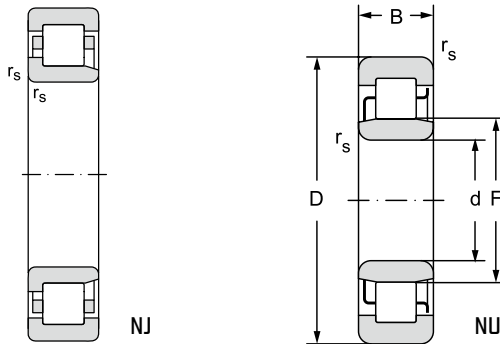
<sup>1)</sup> Admissible axial movement

Fatigue load limit	Limiting speed for lubrication with		Abutment and fillet dimensions							Weight
	$P_u$	grease	oil	d	$d_a$ min	$d_a$ max	$d_b$ min	$D_a$ max	$r_a$ max	
kN	min <sup>-1</sup>		mm							kg
16,71	5000	6300	70	77	82,0	86,0	116	1,5	1,5	1,30
16,71	5000	6300		77	82,0	86,0	116	1,5	1,5	1,30
23,66	4500	5600		77	82,0	86,0	116	1,5	1,5	1,50
23,66	4500	5600		77	82,0	86,0	116	1,5	1,5	1,50
26,31	4000	5000		81	85,0	92,0	138	2,0	2,0	3,10
26,31	4000	5000		81	85,0	92,0	138	2,0	2,0	3,10
18,88	4800	6000	75	82	85,0	90,0	121	1,5	1,5	1,50
18,88	4800	6000		82	85,0	90,0	121	1,5	1,5	1,50
25,06	4300	5300		82	85,0	90,0	121	1,5	1,5	1,60
25,06	4300	5300		82	85,0	90,0	121	1,5	1,5	1,60
30,56	3800	4800		86	93,0	97,0	148	2,0	2,0	3,70
30,56	3800	4800		86	93,0	97,0	148	2,0	2,0	3,70
19,79	4500	5300	80	90	92,0	97,0	130	2,0	2,0	1,70
19,79	4500	5300		90	92,0	97,0	130	2,0	2,0	1,70
32,16	3600	4300		99	97,0	105,0	158	2,0	2,0	4,50
32,16	3600	4300		99	97,0	105,0	158	2,0	2,0	4,50
23,12	4300	5000	85	95	99,0	104,0	140	2,0	2,0	2,10
23,12	4300	5000		95	99,0	104,0	140	2,0	2,0	2,10
36,99	3300	4000		98	103,0	110,0	166	2,5	2,5	5,30
36,99	3300	4000		98	103,0	110,0	166	2,5	2,5	5,30
24,75	4000	4800	90	100	105,0	109,0	150	2,0	2,0	2,60
24,75	4000	4800		100	105,0	109,0	150	2,0	2,0	2,60
39,14	3200	3800		103	110,0	116,0	176	2,5	2,5	6,10
39,14	3200	3800		103	110,0	116,0	176	2,5	2,5	6,10
29,70	3800	4500	95	107	111,0	116,0	158	2,0	2,0	3,20
29,70	3800	4500		107	111,0	116,0	158	2,0	2,0	3,20
41,78	3000	3600		109	119,0	124,0	186	2,5	2,5	7,10
41,78	3000	3600		109	119,0	124,0	186	2,5	2,5	7,10
33,62	3600	4300	100	112	117,0	122,0	168	2,0	2,0	3,80
33,62	3600	4300		112	117,0	122,0	168	2,0	2,0	3,80
45,23	2800	3400		113	125,0	132,0	201	2,0	2,0	8,60
45,23	2800	3400		113	125,0	132,0	201	2,0	2,0	8,60



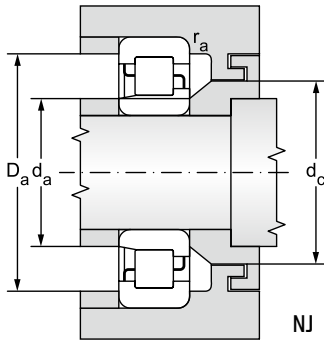
Electrically insulated cylindrical roller bearings

d = 110 to 150 mm

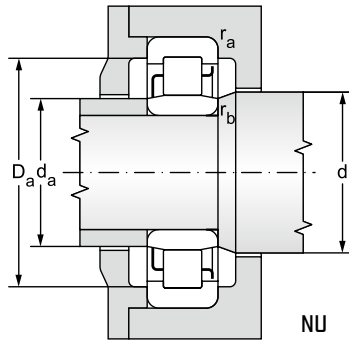


d	Main dimensions						Bearing designation	Basic load rating	
	D	B	r <sub>s</sub>	r <sub>1s</sub>	F	s <sub>1</sub>		dynamic	static
	mm							C <sub>r</sub>	C <sub>or</sub>
110	200	38,00	2,1	2,1	132,500	2,5	<b>NU222EM TM01</b>	293,0	365,0
	200	38,00	2,1	2,1	132,500	2,5	<b>NJ222EM TM01</b>	293,0	365,0
	240	50,00	3,0	3,0	143,000	2,7	<b>NU322EM TM01</b>	450,0	525,0
	240	50,00	3,0	3,0	143,000	2,7	<b>NJ322EM TM01</b>	450,0	525,0
120	180	28,00	2,0	1,1	135,000	2,0	<b>NU1024M TM01</b>	131,0	168,0
	215	40,00	2,1	2,1	143,500	2,5	<b>NU224EM TM01</b>	335,0	420,0
	215	40,00	2,1	2,1	143,500	2,5	<b>NJ224EM TM01</b>	335,0	420,0
	260	55,00	3,0	3,0	154,000	2,7	<b>NU324EM TM01</b>	530,0	610,0
	260	55,00	3,0	3,0	154,000	2,7	<b>NJ324EM TM01</b>	530,0	610,0
130	200	33,00	2,0	1,1	148,000	2,0	<b>NU1026M TM01</b>	162,0	203,0
	230	40,00	3,0	3,0	153,500	2,5	<b>NU226EM TM01</b>	365,0	455,0
	230	40,00	3,0	3,0	153,500	2,5	<b>NJ226EM TM01</b>	365,0	455,0
	280	58,00	4,0	4,0	167,000	2,9	<b>NU326EM TM01</b>	615,0	735,0
	280	58,00	4,0	4,0	167,000	2,9	<b>NJ326EM TM01</b>	615,0	735,0
140	210	33,00	2,0	1,1	158,000	2,0	<b>NU1028M TM01</b>	176,0	250,0
	250	42,00	3,0	3,0	169,000	2,5	<b>NU228EM TM01</b>	395,0	515,0
	250	42,00	3,0	3,0	169,000	2,5	<b>NJ228EM TM01</b>	395,0	515,0
	300	62,00	4,0	4,0	180,000	2,7	<b>NU328EM TM01</b>	665,0	795,0
	300	62,00	4,0	4,0	180,000	2,7	<b>NJ328EM TM01</b>	665,0	795,0
150	225	35,00	2,1	1,5	169,500	2,0	<b>NU1030M TM01</b>	192,0	251,0
	270	45,00	3,0	3,0	182,000	2,4	<b>NU230EM TM01</b>	450,0	595,0
	270	45,00	3,0	3,0	182,000	2,4	<b>NJ230EM TM01</b>	450,0	595,0
	320	65,00	4,0	4,0	193,000	2,7	<b>NU330EM TM01</b>	760,0	920,0
	320	65,00	4,0	4,0	193,000	2,7	<b>NJ330EM TM01</b>	760,0	920,0





NJ



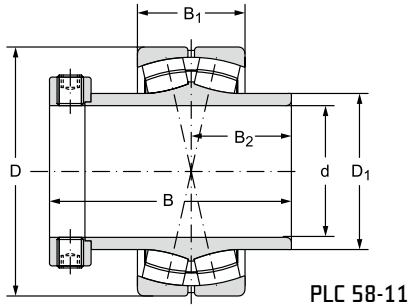
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<sup>1)</sup> Admissible axial movement

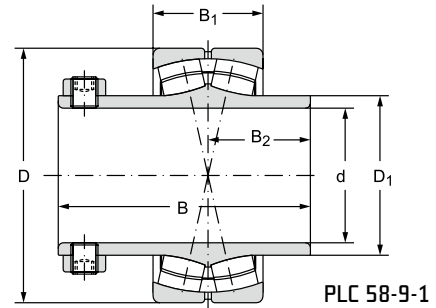
Fatigue load limit	Limiting speed for lubrication with		Abutment and fillet dimensions							Weight
	$P_u$	grease	oil	d	$d_a$ min	$d_a$ max	$d_b$ min	$D_a$ max	$r_a$ max	
kN	min <sup>-1</sup>		mm							kg
39,03	3200	3800	110	122	125,0	135,0	188	2,0	2,0	5,40
39,03	3200	3800		122	125,0	135,0	188	2,0	2,0	5,40
54,13	2600	3000		124	135,0	145,0	226	2,5	2,5	11,8
54,13	2600	3000		124	135,0	145,0	226	2,5	2,5	11,8
18,14	3300	4000	120	128	131,0	138,0	171	2,0	1,0	2,45
43,88	3000	3400		132	138,0	146,0	203	2,0	2,0	6,40
43,88	3000	3400		132	138,0	146,0	203	2,0	2,0	6,40
61,36	2200	2800		134	145,0	156,0	246	2,5	2,5	15,0
61,36	2200	2800		134	145,0	156,0	246	2,5	2,5	15,0
21,30	3200	3800	130	138	143,0	151,0	191	2,0	1,0	3,75
46,52	2600	3200		144	150,0	158,0	216	2,5	2,5	8,00
46,52	2600	3200		144	150,0	158,0	216	2,5	2,5	8,00
72,27	2200	2600		148	155,0	169,0	262	3,0	3,0	18,7
72,27	2200	2600		148	155,0	169,0	262	3,0	3,0	18,7
25,78	3000	3600	140	149	153,0	161,0	201	2,0	1,0	3,90
51,40	2400	3000		154	160,0	171,0	236	2,5	2,5	9,40
51,40	2400	3000		154	160,0	171,0	236	2,5	2,5	9,40
76,53	2000	2400		158	166,0	182,0	282	3,0	3,0	23,0
76,53	2000	2400		158	166,0	182,0	282	3,0	3,0	23,0
25,35	2700	3200	150	159	165,0	173,0	213	2,0	1,5	4,85
58,08	2200	2800		164	170,0	184,0	256	2,5	2,5	12,0
58,08	2200	2800		164	170,0	184,0	256	2,5	2,5	12,0
86,83	1800	2200		168	185,0	195,0	302	3,0	3,0	27,0
86,83	1800	2200		168	185,0	195,0	302	3,0	3,0	27,0



Double row spherical roller bearing  
PLC 58-11; PLC 58-9-1

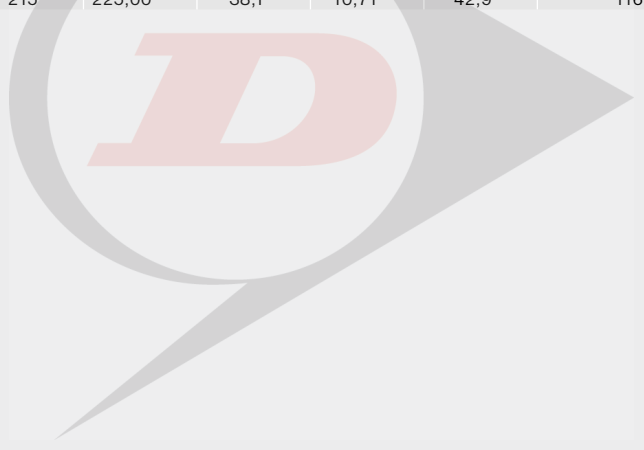


Double row spherical roller bearing  
PLC 010-3



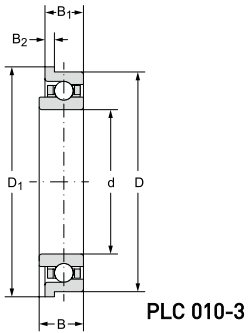
Main dimensions						Basic load rating	
d	D	D <sub>1</sub>	B <sub>1</sub> min	B <sub>2</sub> min	B	dynamic C <sub>r</sub>	static C <sub>or</sub>
mm						kN	
74,6	120	88,34	31,0	31,80	92,0	196	255
76,2	130	88,71	31,0	31,75	92,2	196	255
140,0	215	225,00	38,1	10,71	42,9	116	139

12.12.4

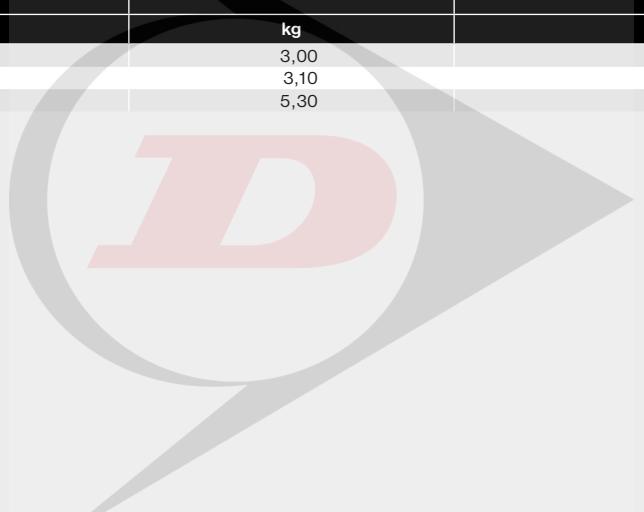




Single row ball bearing PLC 010-3

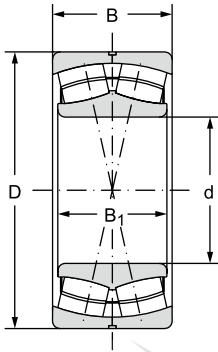


Fatigue load limit	Weight	Bearing designation
$P_u$	~	
kN	kg	
31,10	3,00	<b>PLC 58-11</b>
30,81	3,10	<b>PLC 58-9-1</b>
4,74	5,30	<b>PLC 010-3</b>

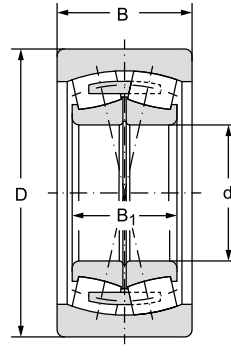




Double row spherical roller bearings PLC 59-10; PLC 511-14



PLC 59-10



PLC 511-14

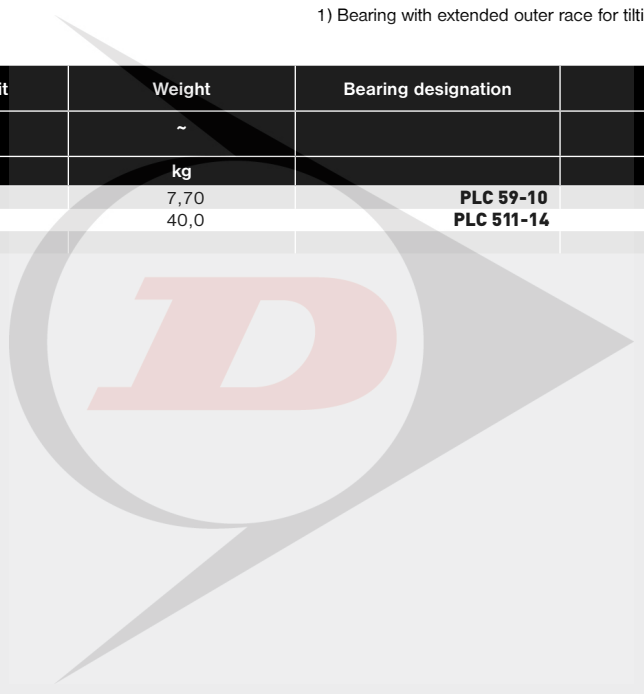
12.12.5

Main dimensions				Basic load rating	
d	D	B <sub>1</sub>	B	Dynamic C <sub>r</sub>	Static C <sub>0r</sub>
mm				kN	
110	180,00	69,0	82,0	501	839
110	288,92	80,0	115,9	786	978



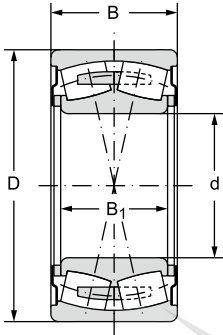
1) Bearing with extended outer race for tilting angles up to 6°  
2) Support pulley

Fatigue load limit	Weight	Bearing designation	Note
$P_u$	~		
kN	kg		
91,52	7,70	<b>PLC 59-10</b>	1)
96,95	40,0	<b>PLC 511-14</b>	2)

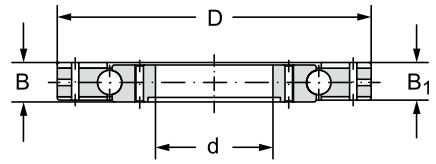




Double row spherical roller bearing PLC 58-2    Single row ball bearing KL 761



PLC 58-2



KL 761

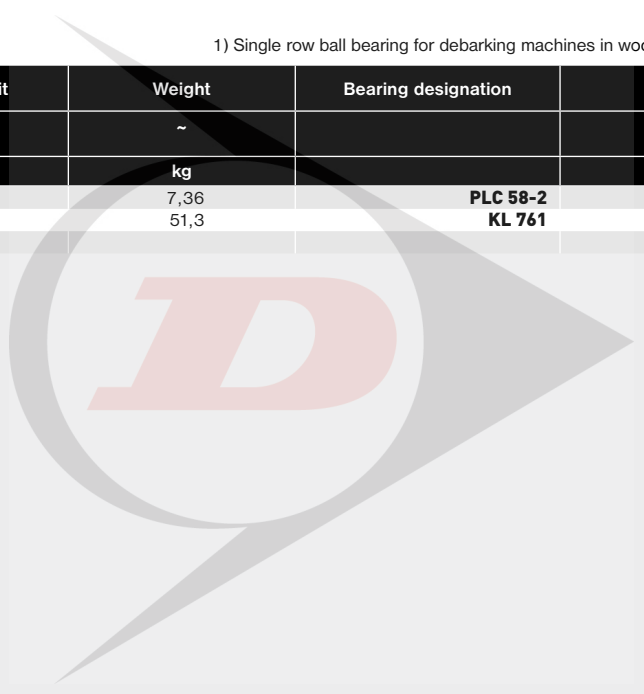
12.12.6

Main dimensions				Basic load rating	
d	D	B <sub>1</sub>	B	Dynamic C <sub>r</sub>	Static C <sub>or</sub>
mm				kN	
65	158,8	48,0	70,0	212	250
559	761,0	36,5	38,2	232	425



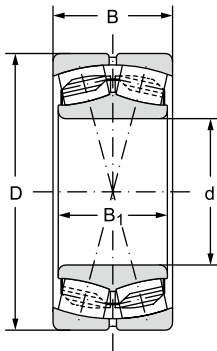
1) Single row ball bearing for debarking machines in woodworking industry

Fatigue load limit	Weight	Bearing designation	Note
$P_u$	~		
kN	kg		
29,48	7,36	<b>PLC 58-2</b>	
7,52	51,3	<b>KL 761</b>	1)

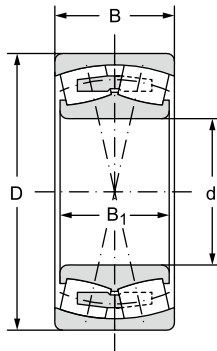




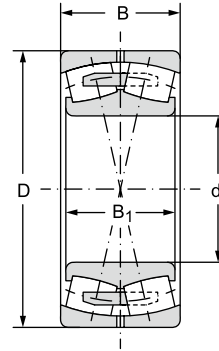
Double row spherical roller bearings PLC 58-6; PLC 59-5; PLC 512-5



PLC 58-6



PLC 59-5



PLC 512-5

12.12.7

Main dimensions				Basic load rating	
d	D	B <sub>1</sub>	B	Dynamic C <sub>r</sub>	Static C <sub>or</sub>
mm				kN	
100	150	62	50	310	550
100	180	69	82	480	710
440	720	226	270	4300	9000







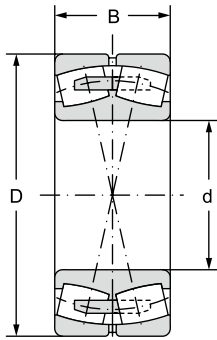
- 1) Double row spherical-roller bearing with increased tipping angle up to 7° for location of concrete agitator transmission.
- 2) Double row spherical-roller bearing with increased tipping angle up to 7° for location of concrete agitator transmission.
- 3) Double row spherical-roller bearing with increased tipping angle up to 7°.

Fatigue load limit	Weight	Bearing designation	Note
$P_u$	~		
kN	kg		
62,73	3,70	<b>PLC 58-6</b>	1)
78,27	10,30	<b>PLC 59-5</b>	2)
647,74	389	<b>PLC 512-5</b>	3)

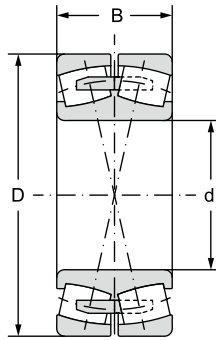




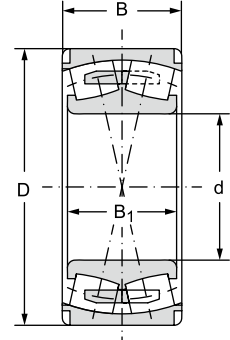
Double row spherical roller bearings PLC 59-7; PLC 510-9; PLC 510-20



PLC 59-7



PLC 510-9



PLC 510-20

12.12.8

Main dimensions				Basic load rating	
d	D	B <sub>1</sub>	B	Dynamic C <sub>r</sub>	Static C <sub>or</sub>
mm				kN	
111,6	215	90	76	564	803
130,0	220	73		570	1080
130,0	225	80		570	1080



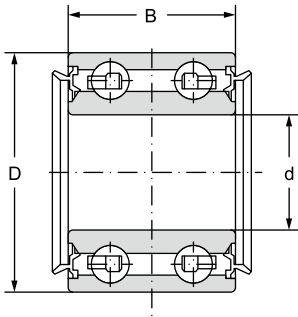
1) Double row spherical roller bearing according to UIC dimensional plan for location of rail vehicle axles with 130 mm journal.

Fatigue load limit		Weight	Bearing designation	Note
$P_u$		~		
kN		kg		
84,5		14,4	PLC 510-20	
111		12,2	PLC 59-7	1)
111		12,2	PLC 510-9	

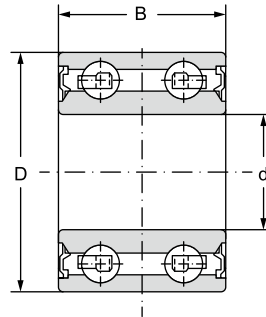




Special double row ball bearings PLC 77-1; PLC 14-28; PLC 14-29



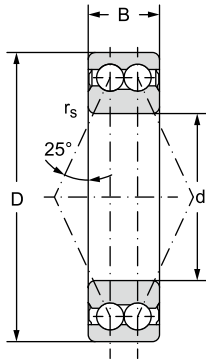
PLC 77-1



PLC 14-28

12.12.9

Main dimensions			Basic load rating		Fatigue load limit
d	D	B	dynamic $C_r$	static $C_{or}$	$P_u$
mm			kN		kN
25	52	43,8	24,3	17,7	0,80
25	52	37,0	24,3	17,7	0,80
36	62	16,0	24,1	27,1	1,23



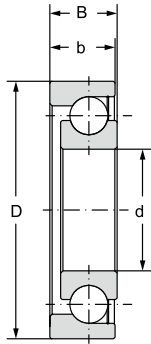
PLC 14-29

Limiting speed for lubrication with		Weight	Bearing designation
grease	oil		
min <sup>-1</sup>		kg	
5250	-	0,301	<b>PLC 77-1</b>
5250	-	0,301	<b>PLC 14-28</b>
4410	-	0,192	<b>PLC 14-29</b>

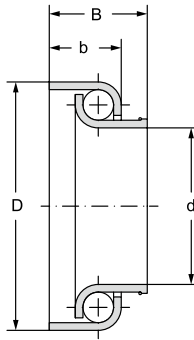




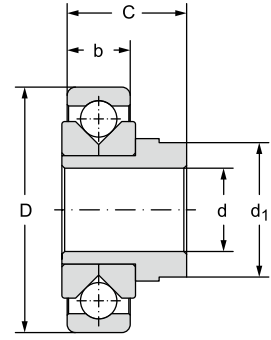
Single row ball bearings PLC 03-29; PLC 03-33; PLC 03-79



PLC 03-29



PLC 03-33



PLC 03-79

12.12.10

Main dimensions			Basic load rating		Fatigue load limit
d	D	B	dynamic $C_r$	static $C_{or}$	$P_u$
mm			kN		kN
17,0	35,0	9,0	8,20	5,30	0,24
22,2	36,9	16,5	5,11	6,31	0,29
10,4	35,0	10,0	4,82	1,36	0,06

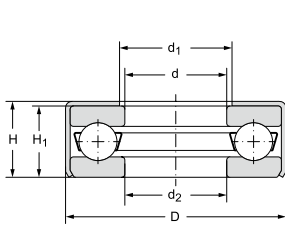
1) track bar location

Limiting speed for lubrication with		Bearing designation	Weight
grease	oil		
min <sup>-1</sup>			~
			kg
18000	21000	<b>PLC 03-29</b>	0,033
1) 12600	1) 17000	<b>PLC 03-33</b>	0,034
		<b>PLC 03-79</b>	0,069

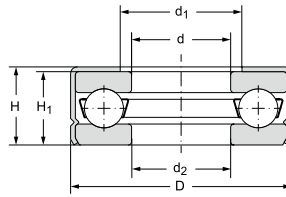




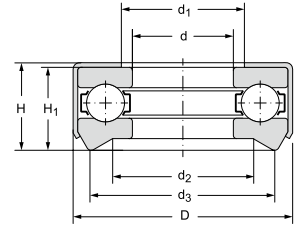
Special thrust ball bearings 511Z30; PLC 23-4; PLC 23-5; 511Z35; PLC 24-2; PLC 24-4; PLC 24-5; PLC 24-6; PLC 23-7



511Z30  
511Z35



PLC 23-4

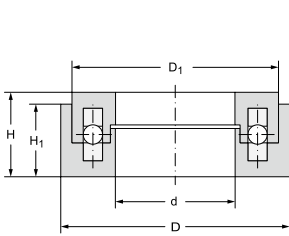


PLC 23-5

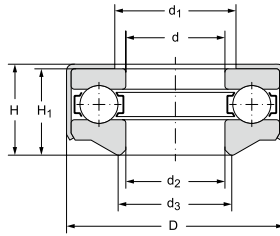
12.12.11

Main dimensions			Basic load rating		Fatigue load limit
d	D	H	dynamic $C_o$	static $C_{oa}$	$P_u$
mm			kN		kN
30,0	49,2	12,0	18,8	31,6	1,44
	49,2	12,0	17,4	28,2	1,28
	49,2	13,6	17,4	28,2	1,28
35,0	53,6	12,8	20,0	38,3	1,74
	53,6	15,5	20,0	38,3	1,74
17,0	35,0	12,3	9,6	15,5	0,70
45,2	65,0	10,8	27,8	57,5	2,61
40,1	59,9	10,8	26,9	51,2	2,33
55,2	78,0	11,6	34,8	78,4	3,56

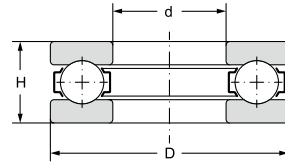




PLC 23-7



PLC 24-2



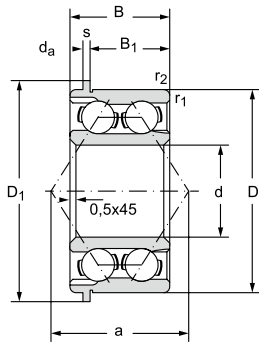
24-4

1) The bearing is designed for oscillatory movement or low revolution frequencies.

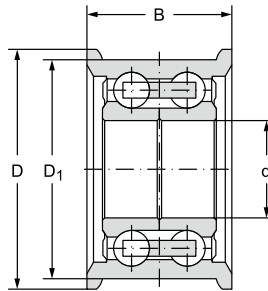
Limiting speed for lubrication with		Weight	Bearing designation	Abutment and fillet dimensions				
grease	oil			$d_1$	$d_2$	$d_3$	$H_1$	$r_{1,2}$
min <sup>-1</sup>		kg	mm					
4200	-	0,086	<b>511Z30</b>	36,0	30,2	-	11,0	0,6
4200	-	0,083	<b>PLC 23-4</b>	36,0	30,8	-	11,0	0,6
4200	-	0,085	<b>PLC 23-5</b>	36,0	30,8	40	12,5	0,6
4000	-	0,093	<b>511Z35</b>	38,0	37,0	-	12,0	0,6
3500	-	0,111	<b>PLC 24-2</b>	38,0	37,0	40	14,7	0,6
1)		0,029	<b>PLC 23-7</b>	17,2	32,4	-	10,4	0,5
3800	5000	0,100	<b>PLC 24-4</b>	-	-	-	-	-
3800	5000	0,090	<b>PLC 24-5</b>	-	-	-	-	-
3200	4200	0,150	<b>PLC 25-6</b>	-	-	-	-	-



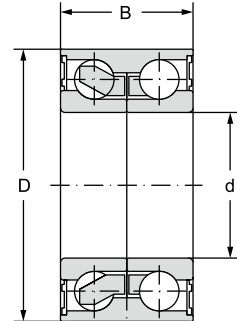
Special double row angular contact ball bearings PLC 15-2; PLC 14-26; PLC 14-25; PLC 14-24; PLC 15-22; PLC 15-12



PLC 15-2



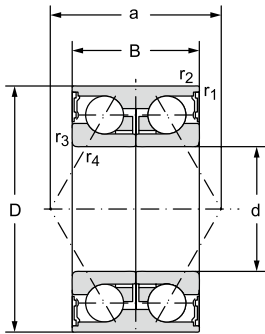
PLC 14-26



PLC 14-25, PLC 14-24, PLC 15-22

12.12.12

Main dimensions			Basic load rating		Fatigue load limit	Limiting speed for lubrication with	
d	D	H	dynamic $C_r$	static $C_{or}$	$P_u$	grease	oil
mm			kN		kN	min <sup>-1</sup>	
25	65,5	25,4	30,4	26,6	1,21	7100	8400
	55,0	20,0	19,2	15,5	0,70	8500	10000
30	60,0	37,0	36,9	30,4	1,38	7000	8300
34	64,0	37,0	36,9	31,0	1,41	6300	7500
37	72,0	37,0	43,8	39,8	1,81	5000	6000
35	68,0	37,0	39,8	38,3	1,74	6500	-



- 1) Bearing with pressed cage guided on balls.  
The bearing is designed for shafts in motor vehicle transmissions.
- 2) Bearing with polyamide cage guided on balls; special sealing ring on both sides filled with lubricant. The bearing is designed for applications in automotive industry (wheel bearing).

PLC 15-12

Weight	Bearing designation	Abutment and fillet dimensions						
		d	D <sub>1</sub>	B <sub>1</sub>	s	r <sub>1,2</sub>	r <sub>3,4</sub>	a
~		mm						
kg								
0,466	<b>PLC 15-21)</b>	25	74	16,5	4,4	1,1	-	40,0
0,280	<b>PLC 14-26)</b>	25	62	28,0	-	-	1,0	26,8
0,450	<b>PLC 14-25)</b>	30	-	-	-	2,5	0,5	50,5
0,320	<b>PLC 14-24)</b>	34	-	-	-	2,8	0,3	53,3
0,550	<b>PLC 15-22)</b>	37	-	-	-	2,8	0,3	57,0
0,534	<b>PLC 15-122)</b>	35	-	-	-	2,5	0,3	50,5