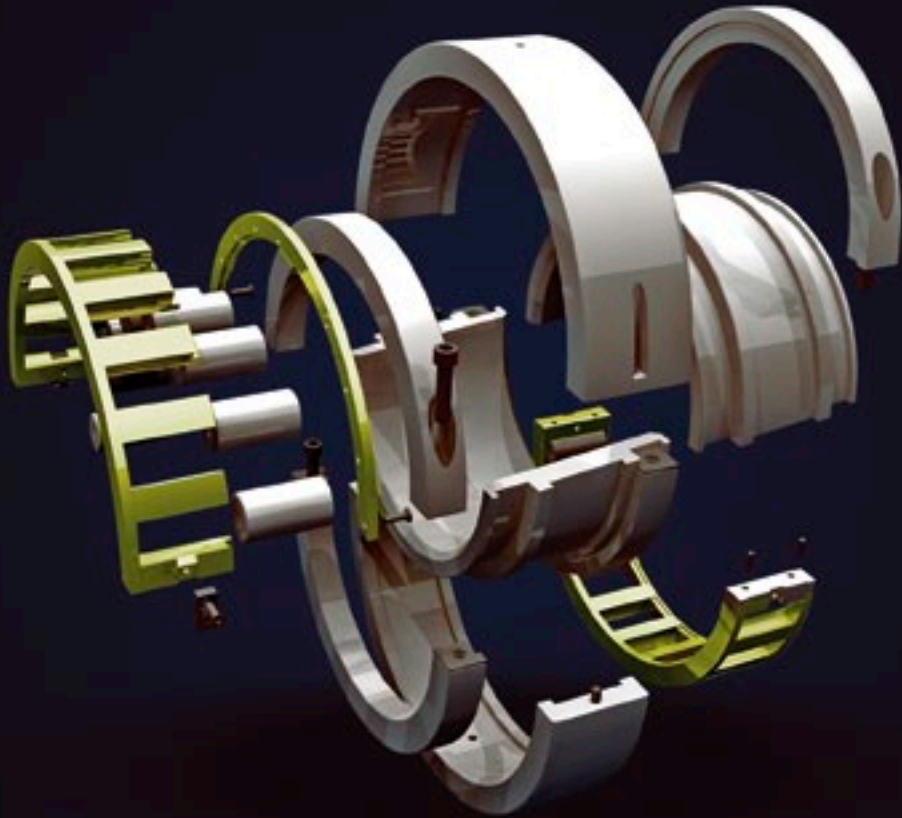




ZKL GROUP



**ZKL CROSS-SPLIT SPHERICAL
AND CYLINDRICAL ROLLER
BEARINGS**





ZKL Cross-Split Spherical and Cylindrical Roller Bearings





ZKL Cross-Split Spherical and Cylindrical Roller Bearings

ZKL Group manufactures and sells a wide assortment of rolling bearings for all sorts of use. ZKL bearings are being applied in heavy and mining industries and in many other industrial sectors as well as in agriculture. Specific attention in our company today is particularly being paid to special rolling bearings for segments of heavy industry. They are the split roller bearings the design and production technology of which have been tested in ZKL for outer diameters up to 900 mm in respect of special cylindrical roller bearings and for outer diameters up to 1 600 mm of spherical roller bearings. The product line of these bearings is being unceasingly broadened and ranks ZKL among world foremost manufacturers.

The use of cross-split bearings turns to advantage namely in conditions where axial installation of a bearing becomes impossible. This relates for example to multiple-bearing shafts, crankshafts, long transmission shafting or for events where bearing installation would be exceedingly time consuming and a longer machinery downtime would cause great operation losses.

The mostly used cross-split bearings worldwide are single row cylindrical and double row spherical roller bearings. Both these design groups are included in production program of ZKL. The parts of these bearings (outer ring, inner ring as well as the cage for centering the rolling elements) are split in radial sense. Most cages are made of massive brass. Connection of two halves of cage is made in a manner to withstand dynamic loads exerted on it during operation. The two halves of inner ring are positioned on the shaft by means of locating rings provided with threaded joint secured against loosening. The dividing joint between the outer ring halves can be vertical to ring face, while the inner ring dividing level is designed inclined at an angle to eliminate shocks in rolling of elements at loaded area of split surface edge.





The next review describes some of industrial installations where these ZKL bearings can be found. **The mining industry** belongs first of all among principal users. Application of bearings comprises the sphere of mining machines and machines for rock processing, sorting and purging. These bearings are also successfully applied in mountings of large fans and blowers, feeders and conveyors. Mounting of a mining machine capacious impeller on two cross-split double row spherical roller bearings meeting extraordinary requirements of the user for service life as well as reliability owing to difficult and costly installation has become a significant reference of ZKL. This sector is closely connected with **metallurgy and steel industry**. Even in this field ZKL split bearings find their use in installations of coal crushers, conveyors, rolling mills drives or in cranes and bucket elevators. ZKL split cylindrical roller bearings were also used in mounting of crankshaft of pilger mill for production of seamless pipes. Other spheres for application of split bearings are conveying systems and ball crushers in power engineering and paper industry or vessels shafts and transmissions as well as crushers and driers in cement mills.





Dimensional Range of Split Cylindrical and Spherical Roller Bearings

The dimensions of special split roller bearings range from diameter of inner ring bore $d = 150 \text{ mm}$ to $1\,200 \text{ mm}$ and to outer ring diameter of $1\,600 \text{ mm}$.

ZKL split cylindrical roller bearings are available in execution capable to accommodate external loads both in radial and axial directions (NU and N prefix) or in radial direction only.

Split spherical roller bearings of ZKL make are capable to accommodate primarily external radial loads and partially axial loads in both directions as well.

Split cylindrical and spherical roller bearings are made in execution with locating rings in peripheral grooves of inner rings. The threaded joints of split rings are connected by special bolts and the manufacturer specifies tightening torque magnitudes for individual dimensions.

Mounting of Bearings

For mounting of bearings with split rings we anticipate use of fit to shaft in h6, h7, h9 values.

Shape allowances of seating surfaces can be used up to 50% of fitting tolerance, generally the seating surfaces accuracy is required to be IT6. Before installing bearings in seating we recommend to finely smear the seating surfaces by mounting paste to minimize occurrence of contact corrosion.

It is advisable to appoint skilled and purpose-trained personnel to bearing mounting.



Calculating Service Life of Split Bearings in Mountings

Basic dynamic load rating of bearings is calculated according to ISO 281 standard, static load rating in conformity with ISO 76.

For calculation of bearings service life use the following equation:

$$L_h = a_1 \cdot a_2 \cdot a_3 \cdot (C_r / P_{ekv})^{3,33} \cdot 16666/n$$

where is

- a_1 reliability coefficient
- a_2 material quality coefficient
- a_3 operating conditions coefficient

The minimum value of external loads should be consulted with manufacturer and his Technical Consulting Services. At minimum loads slippage of rolling elements in contact may occur and for reduction of these slippages optimal radial clearance should be selected.



For minimum service life of 90 percent reliability at standard material and running conditions the coefficients a_1 a_2 a_3 equal to 1

Reliability percentage	95	96	97	98	99
a_1	0.62	0.53	0.44	0.33	0.21

For service life calculation of split roller bearings with radial clearance of C3 až C5 it is necessary to reduce the dynamic load C_r by approx. 5 to 10 percent.

At dimensions stabilization for higher operating temperatures the reduction of C_r is as follows

Temperature °C	170	200	250
C_r reduction (percents)	5	15	25

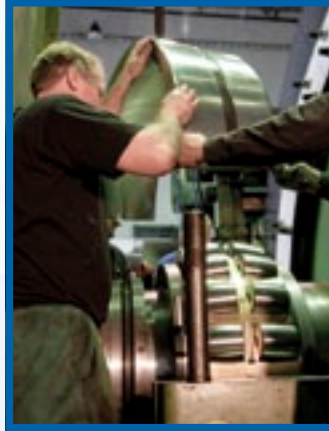




Bearings Lubrication

Lubrication of cross-split bearings should adhere to stipulations ruling for standard roller bearings. It is possible to lubricate both by oil or grease. Selection of lubricant type should comply with operating conditions given by maximum speed frequency, operating temperature and by external loads magnitude.





Recommendation

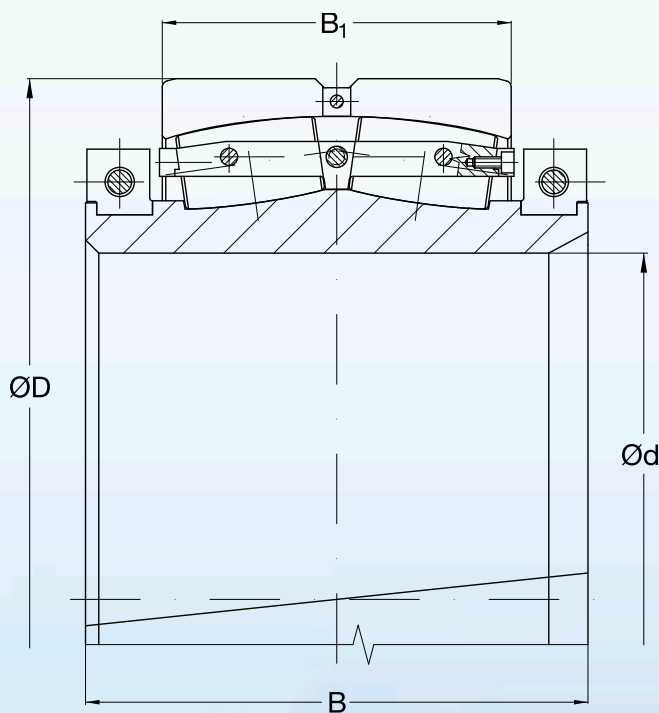
Production of split roller bearings is demanding and in ZKL it is enabled by mastering of special processes of bearing steel heat treatment as well as of splitting technology of individual components. Thus the undesirable material stress and subsequent deformations are eliminated. Specific approach in mounting design and in installation procedures requires close cooperation with the client. For example, in bearings service life calculation the standard equations in most cases cannot be applied without determination of correction coefficients. We recommend therefore to always consult the mounting project and installation procedures with the staff of ZKL Technical Consulting Services.

The split roller bearings can be also offered in other design types and executions (such as radial ball bearings, thrust ball bearings etc.).

In case you intend to replace the original non-split bearing by a split one we suggest to also contact ZKL technical office.



Cross-Split Spherical Roller Bearings

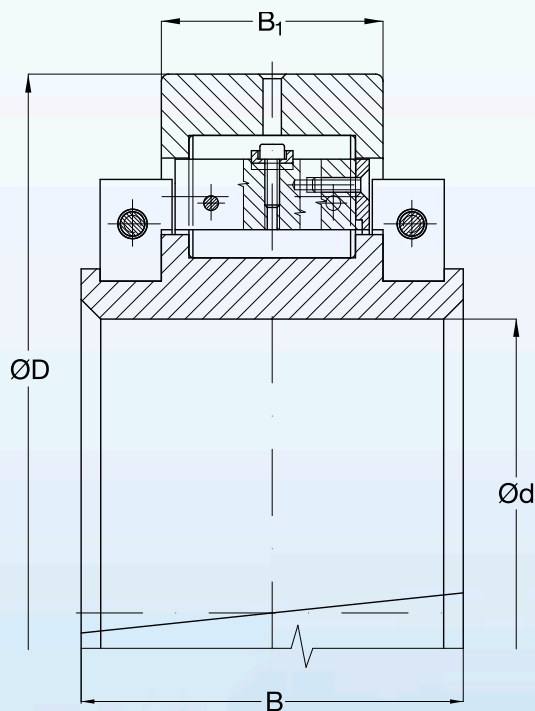


Dimensions				Basic Load Rating		Fatigue Load Limit	Weight	Bearing Designation
				Dynamic	Static			
d	D	B	B_1	C_r	C_{or}	P_u		
mm				kN		kN	kg	
280,000	500	260	176	2764,20	4882,50	395,83	175	PLC512-40
300,000	500	240	160	2791,30	5096,00	410,01	150	PLC512-41
360,000	540	220	134	2340,00	4635,00	359,97	155	PLC512-42
400,000	600	240	148	3024,00	5967,00	449,01	205	PLC512-43
420,000	620	238	150	2937,60	6142,50	456,80	215	PLC512-44
460,000	700	245	165	3378,40	6812,00	490,27	340	PLC512-45
470,000	720	270	167	3712,80	7725,00	551,73	375	PLC512-46
560,000	800	230	150	3507,00	8313,00	570,42	320	PLC512-47
560,000	870	330	200	5161,20	11550,00	780,69	580	PLC512-48
600,000	920	310	212	5809,20	12480,00	828,24	690	PLC512-49
600,000	980	515	375	10816,00	22248,00	1 459,45	1 350	PLC512-50

Dimensions				Basic Load Rating		Fatigue Load Limit	Weight	Bearing Designation
				Dynamic	Static			
d	D	B	B ₁	C _r	C _{0r}	P _u		
mm				kN		kN	kg	

630,000	920	310	212	5922,00	12240,00	807,56	630	PLC512-51
670,000	980	350	230	6568,80	14700,00	951,85	800	PLC512-52
670,000	1150	500	345	12960,00	23450,00	1 474,40	1710	PLC512-39
710,000	950	375	243	5922,50	15912,00	1 028,46	700	PLC512-53
710,000	1 030	360	236	7300,80	16068,00	1 023,98	880	PLC512-54
750,000	1000	360	250	6380,00	17230,00	1 096,15	1220	PLC512-37
750,000	1 090	475	335	10149,00	25200,00	1 579,25	1 300	PLC512-56
800,000	1 060	370	258	7107,00	19344,00	1 208,34	810	PLC512-57
800,000	1 150	490	325	12896,00	31930,00	1 966,45	1 980	PLC512-58
850,000	1 120	390	272	7728,00	21216,00	1 302,62	830	PLC512-59
850,000	1 180	331	206	6568,80	17850,00	1 086,14	880	PLC512-60
850,000	1 280	430	280	10403,00	24128,00	1 447,11	1 550	PLC512-61
850,000	1 280	540	375	12896,00	31930,00	1 915,05	2 350	PLC512-62
900,000	1 180	400	280	8578,50	23256,00	1 404,79	1 100	PLC512-63
900,000	1 340	490	325	12648,00	31500,00	1 860,94	1 800	PLC512-64
950,000	1250	300	220	6400,00	20000,00	1 187,95	987	PLC512-28
950,000	1 250	420	300	9239,10	26520,00	1 575,22	1 300	PLC512-65
1 000,000	1 470	530	345	15184,00	37595,00	2 156,83	3 000	PLC512-66
1 020,000	1 280	352	218	6279,00	19992,00	1 171,74	950	PLC512-67
1 060,000	1 460	500	335	11730,00	35175,00	2 005,90	2 470	PLC512-68
1 060,355	1 400	490	335	11639,00	33280,00	1 911,52	1 800	PLC512-69
1 120,000	1 460	500	335	11960,00	34505,00	1 953,85	2 070	PLC512-70
1 120,000	1 540	525	335	13965,00	39780,00	2 232,01	2 950	PLC512-71

Cross-Split Cylindrical Roller Bearings



Dimensions				Basic Load Rating		Fatigue Load Limit	Weight	Bearing Designation
				Dynamic	Static			
d	D	B	B ₁	C _r	C _{0r}	P _u		
mm				kN		kN	kg	
150,0	254,00	98,40	55,60	453,60	652,96	64,49	16,60	PLC410-49
155,0	254,00	98,40	55,60	453,60	652,96	64,25	16,60	PLC410-50
160,0	273,05	109,00	60,30	513,00	750,48	72,59	20,00	PLC411-29
170,0	285,75	109,00	55,50	550,80	840,58	80,07	23,00	PLC411-30
180,0	285,75	109,00	55,50	550,80	840,58	79,55	23,00	PLC411-31
190,0	311,15	109,00	60,30	575,64	935,98	86,65	25,00	PLC411-32
200,0	311,15	109,00	60,30	575,64	935,98	86,14	25,00	PLC411-33
203,2	368,36	156,00	90,50	1040,00	1520,00	135,28	62,00	PLC411-28
218,0	393,76	156,00	90,50	1200,00	1760,00	153,47	83,80	PLC411-27-1
220,0	393,76	156,00	90,50	1200,00	1760,00	153,32	83,00	PLC411-27
220,0	342,90	115,00	63,50	623,16	1038,80	92,87	32,00	PLC411-34

Dimensions				Basic Load Rating		Fatigue Load Limit	Weight	Bearing Designation
				Dynamic	Static			
d	D	B	B ₁	C _r	C _{0r}	P _u		
mm				kN		kN	kg	
238,0	440,07	156,00	90,50	1248,00	1920,00	162,34	92,00	PLC412-7-1
240,0	374,65	122,00	66,70	691,20	1240,20	107,99	40,00	PLC411-35
240,0	440,07	156,00	90,50	1248,00	1920,00	162,19	92,00	PLC412-7
260,0	431,80	170,00	96,80	1140,00	1940,00	163,04	86,50	PLC412-11
260,0	406,40	128,00	69,00	783,00	1412,98	120,09	50,00	PLC412-12
280,0	406,40	128,00	69,00	783,00	1412,98	119,03	50,00	PLC412-13
300,0	438,15	143,00	74,60	822,96	1543,36	127,21	60,00	PLC412-14
320,0	622,37	272,00	160,40	3100,00	4950,00	379,17	353,00	PLC412-8
320,0	463,55	136,00	74,60	915,84	1740,52	140,91	72,00	PLC412-15
340,0	488,95	136,00	74,60	940,68	1884,68	150,03	78,00	PLC412-16
360,0	520,70	140,00	76,20	1013,04	2044,74	159,84	86,00	PLC412-17
380,0	520,70	140,00	76,20	1013,04	2044,74	158,77	86,00	PLC412-18
400,0	546,10	140,00	76,20	1047,60	2200,56	168,36	95,00	PLC412-19
420,0	571,50	140,00	76,20	1071,36	2356,38	177,77	104,00	PLC412-20
440,0	596,90	140,00	76,20	1110,24	2512,20	186,99	114,00	PLC412-21
460,0	596,90	140,00	76,20	1110,24	2512,20	185,93	114,00	PLC412-22
480,0	628,65	144,00	81,00	1146,96	2578,98	188,15	128,00	PLC412-23
500,0	654,05	168,00	80,20	1190,16	2748,58	198,12	136,00	PLC412-24
530,0	692,15	168,00	81,00	1230,12	2920,30	206,91	164,00	PLC412-25
560,0	717,55	168,00	81,00	1270,08	3090,96	216,11	175,00	PLC412-26
600,0	774,70	172,00	84,10	1404,00	3509,66	240,05	210,00	PLC412-27

Dimensions				Basic Load Rating		Fatigue Load Limit	Weight	Bearing Designation
				Dynamic	Static			
d	D	B	B ₁	C _r	C _{0r}	P _u		
mm				kN		kN	kg	
150,0	292,10	123,80	68,30	810,30	1087,56	104,54	64,00	PLC411-36
155,0	292,10	123,80	68,30	810,30	1087,56	104,19	64,00	PLC411-37
160,0	317,50	140,00	83,30	853,59	1115,64	104,79	39,00	PLC411-38
165,0	317,50	140,00	83,30	853,59	1115,64	104,46	39,00	PLC411-39
180,0	330,20	140,00	83,30	942,39	1286,28	118,44	45,00	PLC411-40
190,0	368,30	156,00	90,50	1098,90	1573,56	141,03	59,00	PLC411-41
195,0	368,30	156,00	90,50	1098,90	1573,56	140,66	59,00	PLC411-42
280,0	463,55	186,00	101,60	1514,04	2316,60	190,53	86,00	PLC412-28
300,0	495,30	193,00	103,20	1622,82	2601,72	209,70	123,00	PLC412-29
320,0	527,05	192,00	106,40	1731,60	2831,76	223,96	150,00	PLC412-30
340,0	565,15	200,00	115,90	1919,19	3175,20	246,18	182,00	PLC412-31
360,0	565,15	200,00	115,90	1919,19	3175,20	244,57	182,00	PLC412-32
380,0	584,20	200,00	111,10	2022,42	3514,32	267,35	186,00	PLC412-33
400,0	615,95	200,00	115,90	2117,88	3713,04	278,08	209,00	PLC412-34
420,0	647,70	200,00	119,10	2234,43	3998,16	295,00	241,00	PLC412-35
440,0	666,75	200,00	115,90	2373,18	4381,56	319,82	250,00	PLC412-36
460,0	666,75	200,00	115,90	2373,18	4381,56	318,11	250,00	PLC412-37
480,0	698,50	223,00	119,10	2497,50	4772,52	341,86	263,00	PLC412-38
500,0	717,55	226,00	115,90	2604,06	5158,08	365,88	272,00	PLC412-39
530,0	762,00	229,00	119,10	2847,15	5547,96	386,59	309,00	PLC412-40
560,0	793,75	233,00	122,20	2969,25	6000,48	412,31	336,00	PLC412-41
600,0	838,20	214,00	119,10	3073,59	6471,36	436,66	381,00	PLC412-42

Dimensions				Basic Load Rating		Fatigue Load Limit	Weight	Bearing Designation
				Dynamic	Static			
d	D	B	B ₁	C _r	C _{0r}	P _u		
mm				kN		kN	kg	

150,0	330,20	160,00	81,00	1176,45	1516,25	142,18	57,00	PLC411-43
160,0	355,60	171,00	103,20	1369,65	1955,00	179,45	72,00	PLC411-44
170,0	355,60	171,00	103,20	1369,65	1955,00	178,42	72,00	PLC411-45
180,0	374,65	178,00	92,10	1476,60	2130,00	191,28	79,00	PLC411-46
190,0	419,10	191,00	97,70	584,20	2527,50	220,69	105,00	PLC412-43
200,0	419,10	191,00	97,70	584,20	2527,50	219,61	105,00	PLC412-44
220,0	469,90	212,00	109,60	1900,95	2703,75	227,42	145,00	PLC412-45
240,0	482,60	211,00	105,60	2118,30	3188,75	264,51	150,00	PLC412-46
260,0	482,60	211,00	105,60	2118,30	3188,75	262,35	150,00	PLC412-47
280,0	495,30	244,00	139,70	2454,10	4041,25	328,22	182,00	PLC412-48
300,0	558,80	244,00	139,70	2518,50	4140,00	326,08	238,00	PLC412-49
340,0	615,95	279,00	158,00	3193,55	5490,00	418,73	318,00	PLC412-50
360,0	615,95	279,00	158,00	3193,55	5490,00	416,14	318,00	PLC412-51
380,0	685,80	292,00	166,70	3533,95	6000,00	442,94	431,00	PLC412-52
400,0	685,80	292,00	166,70	3533,95	6000,00	440,48	431,00	PLC412-53
420,0	700,00	284,00	160,00	4018,10	7507,50	546,04	395,00	PLC412-54
440,0	700,00	284,00	160,00	4018,10	7507,50	543,15	395,00	PLC412-55
460,0	740,00	294,00	170,00	4265,35	7695,00	548,21	431,00	PLC412-56
500,0	850,90	300,00	187,40	4786,30	8801,25	605,14	730,00	PLC412-57
530,0	850,90	300,00	187,40	4786,30	8801,25	601,16	730,00	PLC412-58
560,0	863,60	310,00	196,90	5384,30	10638,75	720,06	635,00	PLC412-59
600,0	890,00	310,00	184,00	5605,10	11412,50	761,94	680,00	PLC412-60

