WD
BALL & ROLLER BEARINGS

Precision Tapered Roller Bearings

高精度圆锥滚子轴承

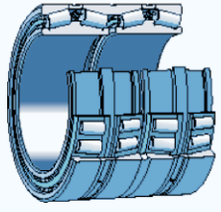
WD的精密滚子轴承包括精密圆柱滚子轴承和精密圆锥滚子轴承，单列或双列结构，精度等级均超过P5级。产品具备很高的旋转精度和尺寸精度。此类产品主要用于主轴等需要高旋转精度的场合，随着精度等级的提高，产品寿命也有明显增加，因此也可使用于需要长寿命的工况。

WD precision roller bearings consist of precision cylindrical roller bearing and tapered roller bearing, both of which have single and double row structure. With the higher precision than P5 standard, they have high dimension and running accuracy accordingly. They are normally used in where requests high running accuracy, such as spindle. And with the improvement of the precision, the product lifespan also has been improved distinctly. Therefore they coule be uesd in working condition that requests long lifespan.

WD品牌的圆锥滚子轴承有多种设计和尺寸以适合多种用途。它们可以分成下列几类：

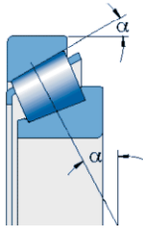
WD品牌单列圆锥滚子轴承

WD品牌双列圆锥滚子轴承



WD品牌四列圆锥滚子轴承

设计特点



WD圆锥滚子轴承有圆锥形内圈和外圈滚道，圆锥滚子排列在两者之间。所有圆锥表面的投影线都在轴承轴线的同一点相聚。这种设计使圆锥滚子轴承特别适合承受复合（径向与轴向）负荷。轴承的轴向负荷能力大部分是由接触角α决定的，α角度越大，轴向负荷能力就越高。角度大小用计算系数e来表示；e值越大，接触角度越大，轴承承受轴向负荷的适用性就越大。圆锥滚子轴承通常是分离型的，即由带滚子与保持架组件的内圈组成的圆锥内圈组件可以与圆锥外圈（外圈）分开安装。

WD圆锥滚子轴承具有对数接触形状，在滚子/滚道接触面提供最佳应力分布。引导法兰和滚子大端滑动表面的特殊设计，会显著促进滚子端面/法兰接触面上润滑油膜的形成。由此而产生的益处包括运行可靠性增强，不对中敏感性降低。

WD品牌公制轴承

产品表所列公制单列圆锥滚子轴承的外形尺寸符合ISO 355-1977标准。

内部游隙和预载荷

WD单列圆锥滚子轴承的内部游隙只有在安装后才能得到，是由该轴承相对另一个以相反方向定位的轴承进行调整后决定的。详细信息见“轴承预载荷”一节。

调整与磨合运转

在调整圆锥滚子轴承时，必须旋转轴承，以便让滚子处于正确的位置，即滚子的大端面必须接触引导法兰。
普通圆锥滚子轴承在运行的最初几个小时里通常有较高的摩擦力矩，在磨合运转期之后就降到较低的水准。在磨合运转期里，轴承温度因高的初始摩擦而迅速增加，在磨合运转期之后就降到平衡的水准。

按照标准制造的轴承几乎不存在这种磨合运转期。这类轴承的初始摩擦非常低，因此温度的上升几乎可以忽略。这一点也适用于高性能CL7C标准的轴承，这些轴承的设计目的是容易调整。

不对中

普通单列圆锥滚子轴承容许内圈相对于外圈的角偏移的能力仅限于几分弧度。轴承具有对数接触形状，能够容许大约2至4分弧度的角偏移。

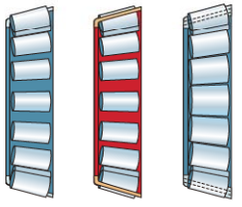
在轴与轴承座的轴线位置恒定时，这些指导性数值才适用。依据负荷与必要的使用寿命，较大的角偏移是可能的。

保持架

WD圆锥滚子轴承装有钢板冲压窗式保持架，滚子引导。图1

玻璃纤维增强尼龙6,6窗式保持架，滚子引导。图2

钢销式保持架。图3



1　2　3

最低负荷

为了提供令人满意的运行，圆锥滚子轴承就像所有球轴承与滚子轴承一样，必须始终承受一定的最低负荷，特别是如果它们要高速运行或者承受高加速度或负荷方向的快速改变时。在这些情况下，滚子与保持架的惯性力以及在润滑剂中摩擦，可能对轴承配置的滚动状况起到有害作用，并可能造成滚子与滚道之间出现有破坏性的滑动。

适用于标准圆锥滚子轴承的必要最低径向负荷可以按照$F_m = 0,02\ C$来估计。

F_m = 是最低径向负荷，kN
C = 是基本额定动负荷，kN（见产品表）

在低温启动时或润滑剂粘度高时，可能需要更大的最低负荷。轴承所支承部件的重量，加上外力，一般超过必要的最低负荷。如果情况不是如此，单列圆锥滚子轴承必须承受额外的径向负荷，这可以通过施加预负荷来方便地得到。

轴承当量动负荷

P = F_r　　当 $F_a/F_r \le e$ 时；
P = $0,4\ F_r + YF_a$　当 $F_a/F_r > e$ 时。
计算系数e和Y的值可以在产品表中找到。

轴承当量静负荷

$P_0 = 0,5F_r + Y_0F_a$
当 $P_0 < F_r$时，应当使用$P_0 = F_r$。
计算系数Y_0的值可以在产品表中找到。

确定轴向力

当有径向负荷施加在单列圆锥滚子轴承上时，负荷从一个滚道传送到另一个滚道时与轴承轴线构成一个角度，导致轴承内产生内部轴向力。在为两个单个轴承组成的轴承配置和/或串联配置的配对轴承计算当量轴承负荷时，必须考虑到这一点。

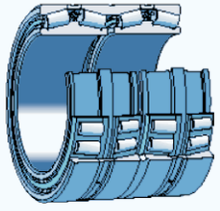
对于各种轴承配置和负荷情况的必要方程式列在表3中。只有在轴承的游隙调整到几乎等于零并且不加任何预负荷的情况下，这些方程式才适用。在所示配置中，轴承A承受径向负荷 FrA，而轴承 B 则承受径向负荷 FrB。负荷 FrA 和 FrB 的值总是被认为是正的，即使它们的作用方向与图中所示方向相反。径向负荷作用于轴承的压力中心（产品表中的尺寸a）。

此外，外力Ka作用于轴（或轴承座）。当Ka = 0时，1c和2c的情况也适用。系数Y的值可以在产品表中找到。

WD tapered roller bearings are produced by WD in many designs and sizes to match their many uses. These can be grouped as follows

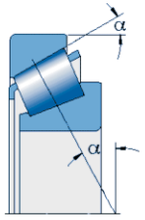
single row tapered roller bearings

paired single row tapered roller bearings



four-row tapered roller bearings

Design features



WD tapered roller bearings have tapered inner and outer ring raceways between which tapered rollers are arranged. The projection lines of all the tapered surfaces meet at a common point on the bearing axis. Their design makes tapered roller bearings particularly suitable for the accommodation of combined (radial and axial) loads. The axial load carrying capacity of the bearings is largely determined by the contact angle ; the larger contact angle the greater axial load carrying capacity . An indication of the angle size is given by the calculation factor ; the larger the value of , the larger the contact angle and the greater suitability of the bearing for carrying axial loads.

Tapered roller bearings are generally separable, i.e. the cone, consisting of the inner ring with roller and cage assembly, can be mounted separately from the cup (outer ring).

WD tapered roller bearings have the logarithmic contact profile that provides optimum stress distribution over the roller/raceway contacts. The special design of the sliding surfaces of the guide flange and large roller ends considerably promote lubricant film formation in the roller end/flange contacts. The resulting benefits include increased operational reliability and reduced sensitivity to misalignment.

Metric bearings

The boundary dimensions of metric single row tapered roller bearings listed in the product tables conform to ISO 355–1977 .

The inner rings with roller and cage assembly and outer rings of AWD tapered roller bearings having the same designation are interchangeable. The tolerance for the total abutment width T of the bearing will not be exceeded if the cones and cups are interchanged.

WD single row metric tapered roller bearings are manufactured to Normal tolerances as standard. Some bearings are also available with reduced width tolerance to tolerance class CLN specifications. Bearings having a J in the prefix are produced as standard to tolerance class CLN specifications.

All bearings having an outside diameter above 420 mm have dimensional accuracy to tolerance class Normal specifications but the running accuracy is better than Normal, being P6 specifications.

The values for Normal and CLN tolerances correspond to ISO 492:2002 (classes Normal and 6X). The values for P6 running accuracy are in accordance with DIN 620–3:1964, which was withdrawn in 1988.

Internal clearance and preload

The internal clearance of single row tapered roller bearings can only be obtained after mounting and is determined by adjustment of the bearing against a second bearing, which provides location in the opposite direction. Further details can be found in the section "Bearing preload".

Adjustment and running–in

When adjusting tapered roller bearings against each other, the bearings must be rotated, so that the rollers assume their correct position, i.e. the large end face of the rollers must be in contact with the guide flange.

Conventional tapered roller bearings normally have a relatively high friction torque during the first hours of operation, which drops to a lower level after the running–in period. During this running–in period, bearing temperature increases rapidly because of the high initial friction and falls off to an equilibrium level as the running–in phase is completed.

This running–in phase is considerably reduced with bearings made to the specification. In these bearings, the initial friction is also much lower, so that temperature increase is almost negligible. This also applies to the high–performance CL7C specification bearings, which are designed for easy adjustment.

Misalignment

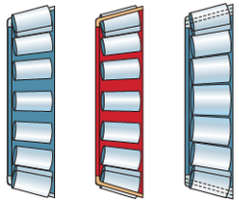
The ability of a conventional single row tapered roller bearing to accommodate angular misalignment of the inner ring with respect to the outer ring is limited to a few minutes of arc. Bearings have the logarithmic contact profile and can tolerate misalignments of approximately 2 to 4 minutes of arc.

These guideline values apply provided the position of the shaft and housing axes are constant. Larger misalignment is possible, depending on the load and requisite service life. For additional information, please contact the application engineering service.

Cages

WD tapered roller bearings are fitted with one of the following cages.

–A pressed window–type steel cage, roller centred.
–An injection moulded window–type cage of glass fibre reinforced polyamide 6,6, roller centred.
–A steel pin–type cage .



Minimum load

In order to provide satisfactory operation, tapered roller bearings, like all ball and roller bearings, must always be subjected to a given minimum load, particularly if they are to operate at high speeds or are subjected to high accelerations or rapid changes in the direction of load. Under such conditions, the inertia forces of the rollers and cage, and the friction in the lubricant, can have a detrimental influence on the rolling conditions in the bearing arrangement and may cause damaging sliding movements to occur between the rollers and raceways.

The requisite minimum radial load to be applied to standard tapered roller bearings can be estimated from

$$F_{rm} = 0{,}02\ C$$

Where

F_{rm}	=	minimum radial load, kN
C	=	basic dynamic load rating, kN (see product table)

When starting up at low temperatures or when the lubricant is highly viscous, even greater minimum loads may be required. The weight of the components supported by the bearing, together with external forces, generally exceeds the requisite minimum load. If this is not the case, the single row tapered roller bearing must be subjected to an additional radial load, which can be achieved easily by applying preload. For additional information, refer to the section “Bearing preload”.

Equivalent dynamic bearing load

P	=	Fr	when $F_a/F_r = e$
P	=	0,4 Fr + Yfa	when $F_a/F_r > e$

The values of the calculation factors e and Y can be found in the product tables.

Equivalent static bearing load

$$P_0 = 0{,}5F_r + Y_0F_a$$

When $P_0 < F_r$, $P_0 = F_r$ should be used. The value of the calculation factor Y_0 can be found in the product table.

Determination of axial load

When a radial load is applied to a single row tapered roller bearing, the load is transmitted from one raceway to the other at an angle to the bearing axis and an internal axial force will be produced in the bearing. It must be considered when calculating the equivalent bearing loads for bearing arrangements consisting of two single bearings and/or bearing pairs arranged in tandem.

The necessary equations are provided in table 3 for the various bearing arrangements and load cases. The equations are only valid if the bearings are adjusted against each other to practically zero clearance, but without any preload. In the arrangements shown, bearing A is subjected to a radial load FrA and bearing B to radial load FrB. Values of the loads FrA and FrB are always considered positive even when they act in the direction opposite to that shown in the figures. The radial loads act at the pressure centres of the bearings (dimension a in the product table).

In addition to an external force Ka acts on the shaft (or on the housing). Cases 1c and 2c are also valid when Ka = 0. Values of the factor Y can be found in the product table.

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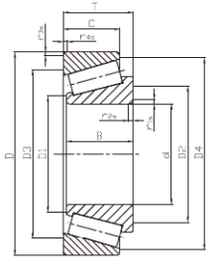
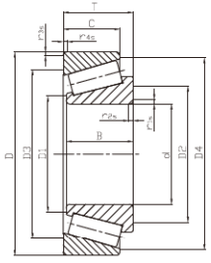
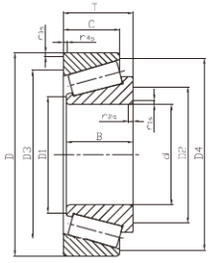
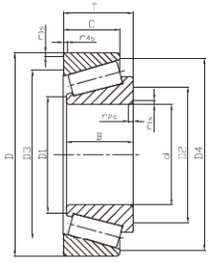




Single Row Tapered Roller Bearings

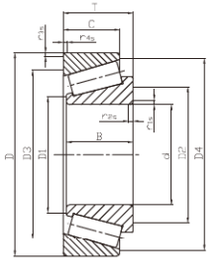
Boundary Dimensions																			
d	D	B	C	T	R1smin R2smin	R3smin R4smin	M kg	Cr KN	Cor KN	E	Y	Y0	n1/min	Bearing Code	D1max	D2min	D3min	D4min
100	150	32	24	32	2	1.5	1.93	173	285	0.46	1.3	0.7	2200	32020	109	109	134	144
100	150	39	32.5	39	2	1.5	2.44	224	400	0.29	2.1	1.2	2200	33020	108	109	135	143
100	180	34	29	37	3	2.5	3.81	250	325	0.42	1.4	0.8	2000	30220	116	112	157	168
100	180	46	39	49	3	2.5	5.21	335	475	0.42	1.4	0.8	1900	32220	114	112	154	171
100	180	63	48	63	3	2.5	6.91	430	655	0.4	1.5	0.8	1900	33220	112	112	151	172
100	215	47	39	51.5	4	3	8.47	415	510	0.35	1.7	1	1700	30320	127	114	184	197
100	215	51	35	56.5	4	3	9.1	380	480	0.83	0.7	0.4	1600	31320	121	114	168	202
100	215	73	60	77.5	4	3	13.3	610	850	0.35	1.7	1	1700	32320	123	114	177	200
105	160	35	26	35	2.5	2	2.44	204	325	0.44	1.4	0.7	2000	32021	116	115	143	154
105	160	43	34	43	2.5	2	3.06	265	450	0.28	2.1	1.2	2000	33021	116	115	145	153
105	190	36	30	39	3	2.5	4.51	280	365	0.42	1.4	0.8	1900	30221	122	117	165	177
105	190	50	43	53	3	2.5	6.39	380	550	0.42	1.4	0.8	1800	32221	120	117	161	180
105	225	77	63	81.5	4	3	15.4	670	930	0.35	1.7	1	1600	32321	128	119	185	209
110	170	38	29	38	2.5	2	3.1	240	390	0.43	1.4	0.8	1900	32022	122	120	152	163
110	170	47	37	47	2.5	2	3.88	300	520	0.29	2.1	1.2	2000	33022	123	120	152	161
110	180	56	43	56	2.5	2	5.64	365	630	0.42	1.4	0.8	1800	33122	121	120	155	174
110	200	38	32	41	3	2.5	5.32	315	415	0.42	1.4	0.8	1800	30222	129	122	174	187
110	200	53	46	56	3	2.5	7.43	415	600	0.42	1.4	0.8	1700	32222	126	122	170	190
110	240	50	42	54.5	4	3	11.3	480	585	0.35	1.7	1	1500	30322	141	124	206	220
110	240	57	38	63	4	3	12.7	465	585	0.83	0.7	0.4	1500	31322	135	124	188	224
110	240	80	65	84.5	4	3	18.3	735	1020	0.35	1.7	1	1500	32322	137	124	198	222
120	180	38	29	38	2.5	2	3.32	250	425	0.46	1.3	0.7	1800	32024	131	130	161	173
120	180	48	38	48	2.5	2	4.22	310	560	0.31	2	1.1	1800	33024	132	130	160	171
120	215	40	34	43.5	3	2.5	6.34	335	450	0.44	1.4	0.8	1600	30224	140	132	187	201
120	215	58	50	61.5	3	2.5	9.42	480	735	0.44	1.4	0.8	1600	32224	136	132	181	204
120	260	55	46	59.5	4	3	14.5	560	710	0.35	1.7	1	1400	30324	152	134	221	237
120	260	62	42	68	4	3	16	540	695	0.83	0.7	0.4	1300	31324	145	134	203	244
120	260	86	69	90.5	4	3	22.1	670	965	0.39	1.5	0.8	1400	32324	148	134	213	239

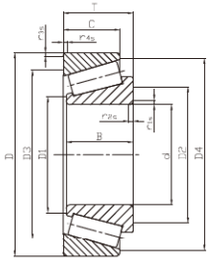




Single Row Tapered Roller Bearings

Boundary Dimensions d	D	B	C	T	R1smin R2smin	R3smin R4smin	M kg	Cr KN	Cor KN	E	Y	Y0	n1/min	Bearing Code	D1max	D2min	D3min	D4min
130	200	45	34	45	2.5	2	5.06	325	550	0.43	1.4	0.8	1600	32026	144	140	178	192
130	230	40	34	43.75	4	3	7.16	355	475	0.44	1.4	0.8	1500	30226	152	144	203	217
130	230	64	54	67.75	4	3	11.7	560	850	0.44	1.4	0.8	1500	32226	146	144	193	219
130	280	66	44	72	5	4	19.4	610	800	0.83	0.7	0.4	1200	31326	157	148	218	261
140	210	45	34	45	2.5	2	5.38	340	600	0.46	1.3	0.7	1500	32028	153	150	187	202
140	250	42	36	45.75	4	3	9	415	560	0.44	1.4	0.8	1400	30228	163	154	219	234
140	250	68	58	71.75	4	3	14.8	640	1000	0.44	1.4	0.8	1300	32228	159	154	210	238
140	300	70	47	77	5	4	23.8	695	900	0.83	0.7	0.4	1200	31328	169	158	235	280
150	225	48	36	48	3	2.5	6.56	390	680	0.46	1.3	0.7	1400	32030	164	162	200	216
150	270	45	38	49	4	3	11.2	465	640	0.44	1.4	0.8	1300	30230	175	164	234	250
150	270	73	60	77	4	3	18.5	735	1140	0.44	1.4	0.8	1300	32230	171	164	226	254
150	320	75	50	82	5	4	28.9	780	1020	0.83	0.7	0.4	1100	31330	181	168	251	300
160	240	51	38	51	3	2.5	7.87	425	750	0.46	1.3	0.7	1300	32032	175	172	213	231
160	290	48	40	52	4	3	13.5	405	585	0.37	1.6	0.9	1200	30232	189	174	252	269
160	290	80	67	84	4	3	23.8	865	1370	0.44	1.4	0.8	1200	32232	183	174	242	274
170	230	38	30	38	2.5	2	4.36	300	560	0.38	1.6	0.9	1400	32934	183	180	213	222
170	260	57	43	57	3	2.5	10.6	500	800	0.44	1.4	0.7	1200	32034	187	182	230	249
170	310	86	71	91	5	4	29.3	980	1560	0.44	1.4	0.8	1100	32234	196	188	259	294
180	250	45	34	45	2.5	2	6.55	360	710	0.48	1.3	0.7	1200	32936	193	190	225	241
180	280	64	48	64	3	2.5	14.2	630	1100	0.42	1.4	0.8	1100	32036	199	192	247	267
180	320	86	71	91	5	4	30.7	1000	1660	0.45	1.3	0.7	1000	32236	204	198	267	303
190	260	45	34	45	2.5	2	6.88	375	750	0.48	1.3	0.7	1200	32938	204	200	235	251
190	290	64	48	64	3	2.5	14.8	630	1120	0.44	1.4	0.8	1100	32038	209	202	257	279
190	340	92	75	97	5	4	36.7	1140	1830	0.44	1.4	0.8	950	32238	216	207	286	323
200	280	51	39	51	3	2.5	9.38	500	930	0.39	1.5	0.8	1100	32940	216	212	257	271
200	310	70	53	70	3	2.5	19.1	750	1370	0.43	1.4	0.8	1000	32040	221	212	273	297





Single Row Tapered Roller Bearings

Boundary Dimensions d	D	B	C	T	R1smin R2smin	R3smin R4smin	M kg	Cr KN	Cor KN	E	Y	Y0	n1/min	Bearing Code	D1max	D2min	D3min	D4min
200	360	98	82	104	5	4	44.1	1320	2080	0.41	1.5	0.8	950	32240	226	217	302	340
220	300	51	39	51	3	2.5	10.1	500	980	0.43	1.4	0.8	1000	32944	234	232	275	290
220	340	76	57	76	4	3	24.7	880	1630	0.43	1.4	0.8	950	32040	243	234	300	326
240	360	76	57	76	4	3	26.2	900	1660	0.46	1.3	0.7	850	32048	261	254	318	346
260	360	63.5	48	63.5	3	2.5	18.8	750	1500	0.41	1.5	0.8	850	32952	279	272	328	347
260	400	87	65	87	5	4	38.7	1160	2160	0.43	1.4	0.8	800	32052	287	278	352	383
280	420	87	65	87	5	4	41.1	1200	2280	0.46	1.3	0.7	750	32056	305	298	370	402
300	460	100	74	100	5	4	58.3	1500	2850	0.43	1.4	0.8	670	32060	329	318	404	439
320	480	100	74	100	5	4	61.9	1560	3050	0.46	1.3	0.7	630	32064	350	338	424	461

Remarks: If the specifications are not listed above, please contact WD bearings.
Email:sales@wd-bearing.com