

Cylindrical Roller Bearings

Cylindrical Roller Bearings



Cylindrical roller bearing



Type E cylindrical roller bearing



Double row cylindrical roller bearing

Cylindrical roller bearings

Since the rollers of cylindrical roller bearings make line contact with the raceways, these bearings can support heavy radial loads and are suitable for high speed operation. Cylindrical roller bearings come in various configurations as shown in dimensional table. The rollers are guided by the collars of either the inner or outer ring.

Since NU and N type bearings are not provided with a collar on the inner or outer ring, the inner and outer ring can float axially relative to the other under an axial load. These bearings are most suitable for use on the free side of the shaft. Bearing Types NJ, NUP, NH, and NF having collar rings on both the inner and outer ring and can receive a certain amount of axial load. These bearing types are sometimes used on the fixed side of the shafts.

Since cylindrical roller bearings are separable, they can easily be mounted or dismounted in cases when interference fits are required.

Both pressed and machined cages, shown in Table 1, are used in cylindrical roller bearings.

Table 1 The standard cages for cylindrical roller bearings

Bearing series	Pressed cage ¹⁾	Machined cage
NU10, NJ10, NUP10 N10	—	1005~10/500
NU2, NJ2, NUP2 N2, NF2	204~230	232~264
NU22, NJ22, NUP22 N22	2204~2230	2232~2264
NU3, NJ3, NUP2 N3, NF3	304~324	326~356
NU23, NJ23, NUP23 N23	2304~2320	2322~2356
NU4, NJ4, NUP4 N4, NF4	405~416	417~430

1) Machined cages are manufactured at the customer's request as required for high speed operations or other uses. Please consult with NTN.

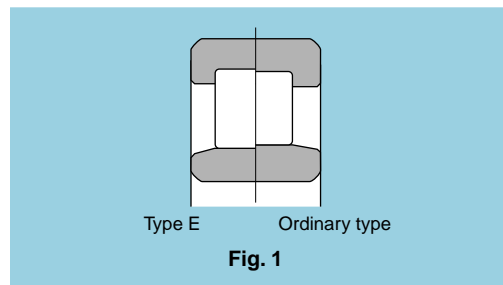
Please note that the bearing's basic load rating with a standard cage design would vary from the values shown in the bearing table if a change of cage design results in a change in the number of rollers.

Type E cylindrical roller bearings

The boundary dimensions of Type E cylindrical roller bearings are the same as those of the standard type. The load capacity of Type E bearings is increased by enlarging the roller diameter, increasing roller length, and by increasing the number of rollers.

The bearings are classified by attaching the suffix "E" at the end of the basic number.

Comparison of the inside structure between Type E and ordinary type (Standard)



Since Type E bearings have a larger load rating permits using bearings with a smaller outer diameter and the same shaft diameter, as shown in Fig. 2. By using the same bearing outside diameter and increasing the bearing bore diameter, the larger can be used to provide greater rigidity and still maintain the same load capacity.

Please note that the rollers of Type E cylindrical roller bearings are not interchangeable because the inscribed circle diameter of the bearing is different from that of standard cylindrical roller bearings.

Plastic cages, pressed cages and machined cages shown in Table 2 are used for these bearings.

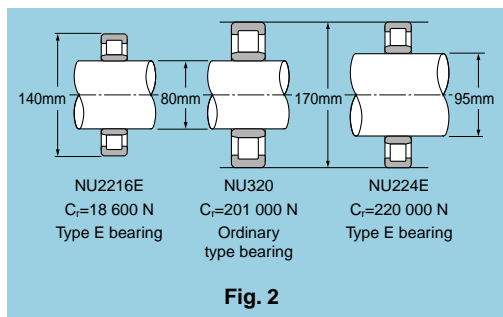


Fig. 2

The plastic cages, pressed cages and machined cages shown in Table 2 are used for these bearings.

Table 2 The standard cages for Type E cylindrical roller bearings

Bearing series	Plastic cage	Pressed cage ¹⁾	Machined cage
NU2E, NJ2E NUP2E	204E~212E	213E~220E	222E~240E
NU22E, NJ22E NUP22E	2204E~2208E	2209E~2220E	2222E~2240E
NU3E, NJ3E NUP3E	304E~312E	313E~316E	317E~332E
NU23E, NJ23E NUP23E	2304E~2307E	2308E~2316E	2317E~2332E

Note 1) Machined cages are manufactured at the customer's request as required for high speed operations or other uses. So, please consult with NTN.

Cylindrical roller bearings for high axial load use (Type HT)

Cylindrical roller bearings, such as Type NUP, which have ribs on both the inner and outer ring can be loaded with both axial and radial forces at the same time.

By improving the geometry of the flange face on Type HT bearings, and furthermore, by giving them high accuracy, a large axial force can be placed on the bearing.

Double row cylindrical roller bearings

Double row cylindrical roller bearings of Types NN or NNU are generally used on main shafts of machine tools requiring lightweight (thin-walled) bearings, the rolls of rolling mills and print drums of duplicators (printing machines).

The radial clearance of a bearing with a tapered bore is adjusted by the distance the bearing inner ring is pushed onto the tapered shaft.

Machined cages are standard to this type of bearing.

Allowable misalignment

Setting the contact conditions of the rollers with raceway not only prevents the occurrence of edge loading at the contact surface but also tolerates some misalignment between the inner and outer rings for mounting error. The allowable misalignment for cylindrical roller bearings is approximately 0.001 radian (0°, 3.5') for bearing series 0 and 1 and 0.0005 radian (0°, 1.5') for bearing series 2. For double row cylindrical roller bearings, basically no misalignment is permitted.

Table 3 Inscribed and circumscribed circle diameters of rollers of interchangeable cylindrical roller bearings
Unit: μm

Nominal diameter of bearings $d(\text{mm})$	Dimensional difference of inscribed circle diameter of rollers Δf_w	Dimensional difference of circumscribed circle diameter of rollers Δe_w	
		high	low
over	incl.	high	low
17 ¹⁾	20	+10	0
20	50	+15	0
50	120	+20	0
120	200	+25	0
200	250	+30	0
250	315	+35	0
315	400	+40	0
400	500	+45	0

1) 17 mm is included in this dimensional division.

Note: Interchangeable cylindrical roller bearings mean bearings having an identical nominal number of a group whose function is not lowered when any of the inner or outer rings are combined at one's option.

Cylindrical Roller Bearings

Allowable axial load for cylindrical roller bearings

Cylindrical roller bearings have flanges on both the inner and outer rings can be loaded with a certain axial force at the same time. Unlike the basic dynamic load rating which is determined by the development of rolling fatigue, a permissible dynamic axial load of a rotating cylindrical roller bearing is determined by heat generation, seizure, etc., at the sliding contact surfaces of the guide flanges and end faces of the rollers. The allowable axial load is approximated by the formula below which is based on past experience and experiments.

where,

- P : Allowable axial load during rotation N
- k : Coefficient determined by internal bearing geometry (Please refer to Table 4)
- d : Bore diameter of the bearings mm
- P_z : Allowable face pressure (bearing stress) of the collar Mp_a (Please refer to Fig. 3)

However, if the ratio axial load/radial load is large, normal rolling motion of the roller cannot be achieved. Therefore, a value exceeding $F_{a \max}$ shown in Table 4 should not be used.

Moreover, when applying axial loads, the following guidelines are important:

- 1) Be careful to specify proper axial internal clearance.
- 2) Use a lubricant containing an extreme pressure additive.
- 3) In case of severe axial loads, increase the mounting accuracy and perform test running of the bearing.

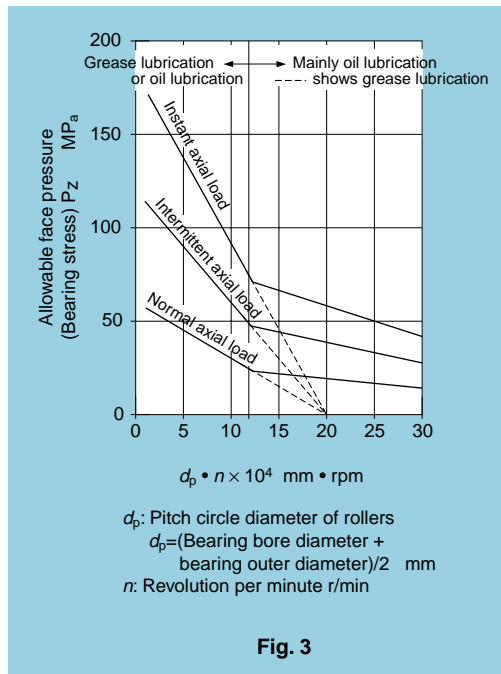


Table 4 Value of coefficient k and allowable axial load ($F_{a \max}$)

Bearing series	k	$F_{a \max}$ N
NJ, NUP10	0.040	$0.4 F_r$
NJ, NUP, NF, NH2, NJ, NUP, NH22		
NJ, NUP, NF, NH3, NJ, NUP, NH23	0.065	$0.4 F_r$
NJ, NUP, NH2E, NJ, NUP, NH22E	0.050	$0.4 F_r$
NJ, NUP, NH3E, NJ, NUP, NH23E	0.080	$0.4 F_r$
NJ, NUP, NH4	0.100	$0.4 F_r$

In cases of axial loads being placed on large sized cylindrical roller bearings (for example, bearing bore diameters of 300 mm or more), large axial loads being placed on the bearing under low speed conditions, or moment forces being applied, please consult with NTN Engineering.

For cylindrical roller bearings subjected to high axial loads use Type HT. These HT bearings can be loaded with an axial force of 1.3 to 1.5 times greater than the standard bearing. However, consideration of loading conditions, lubrication methods, mounting dimensions, etc., are necessary, Please consult NTN Engineering.